BOSTON PUBLIC LIBRARY
3 9999 06585 493 5

GOVDOC
BRA
4938
Appendices

ICES

DRAFT

WATER TRANSPORTATION IN BOSTON HARBOR

Issues and Opportunities

DRAFT

DRAFT

HARBORPARK

CITY OF BOSTON, RAYMOND L. FLYNN, MAYOR

BOSTON REDEVELOPMENT AUTHORITY

JAMES K. FLAHERTY, ACTING CHAIRMAN
JOSEPH WALSH
CLARENCE J. JONES
MICHAEL F. DONLAN
FRANCIS X. O'BRIEN
KANE SIMONIAN, SECRETARY
STEPHEN COYLE, DIRECTOR

APPENDIX 1

VESSEL TERMINOLOGY

VESSEL TERMINOLOGY

ed a table (VESSEL CHARACTERISTICS) giving various characteristics of
ne following are some of the uses to be made of this information:

loat-size. Needed also for calculating the displacement of the vessel.

ing for vessels. Needed also for calculating the vessel displacement.

ths of vessel berths and approach channels. Needed to determine the vessel

ne vessel measured in long tons of saltwater. The displacement, although
ross or net register tons. These two terms are measures of space inside the
feet of space. The displacement is used in the calculation of the kinetic
pier/float. The kinetic energy is used to size the moorings for the floats,
rs on the pier or float.

area of each vessel above the waterline, in square feet. This area is used in
vessel when it is moored against the pier/float.

to the first deck. Many vessels use the first deck for loading and unload-

pe of fuel should be available.

al single displacement or whether it is a catamaran, air cushion vehicle,
wood, aluminum or fiberglass is of interest when determining cathodic

ing of passengers can be accomplished. This information is important
various vessels.

side access facilities depends upon the number of passengers to be

ading and what other amenities might be needed shoreside.

ss to the vessel is needed. This is important when deciding how the

Boston Harbor, there are several different types of vessels in use in

te foam, fiberglass and aluminum vessel built by Blount Marine Cor-
the materials makes the overall weight of the vessel considerably less
saving in weight means a saving in power needed to propel the vessel
e hull can withstand ice up to six (6) inches.

onventional form has both hulls
oothly than the usual single dis-
power for the same speed.

e of catamaran with submerged

ler the hull to keep it just off the
e the containment area. Its ad-
ss the water at high speeds with

support it when it is moving. It
s like Boston it cannot operate at
any type of floating debris which

ities (Maine D.O.T. ferries); side-
side-loading using side loading

ne. The type of fuel is important

APPENDIX 2

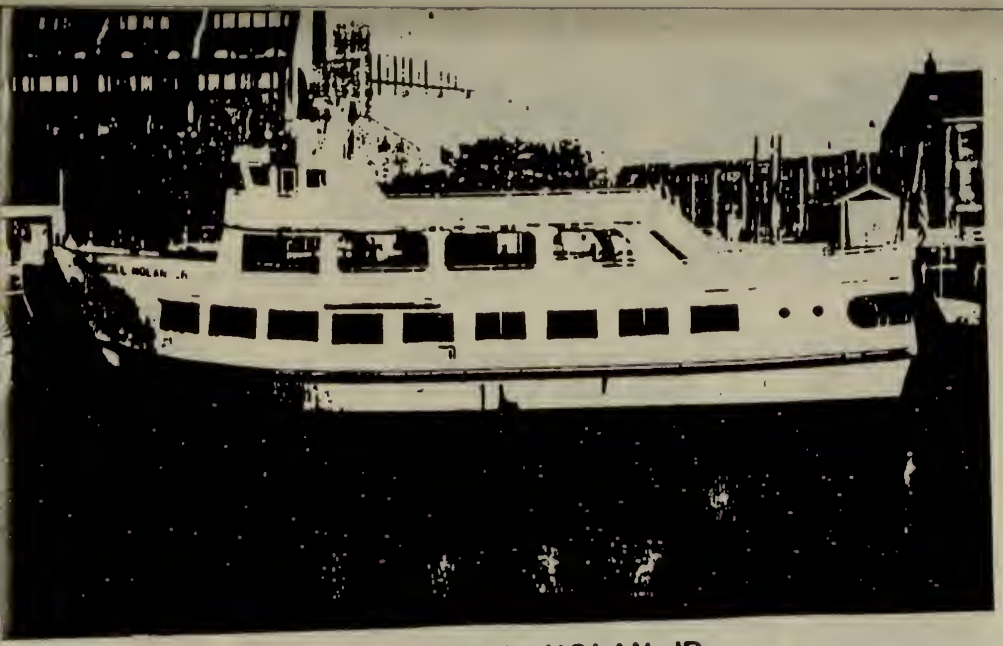
VESSELS OPERATING IN BOSTON HARBOR

VESSEL CHARACTERISTICS

	Length	Beam	Draft	Displ	Area	Freeod	Power	Hull	Loading Height----	No. Pass	Use	Loading-----
BOSTON HARBOR CRUISE LINES												
FREDERICK L. NOLAN, JR	90	32	6	247	2,300	4'	Diesel	S-St		550		
FORT INDEPENDENCE	90	32	6	247	2,000	4'	Diesel			520		
FORT WARREN	70	37	5	185	2,200	3.6'	Diesel			340		
MARTHA WASHINGTON	65	27	5	125	1,300	3.8'	Diesel			210		
ABIGAIL ADAMS	65	20	5	93	1,100	3.8'	Diesel			146		
BAY STATE-SPRAY & PROVINCETOWN STEAMSHIP CO.												
PROVINCETOWN II	194	32	7.7	683	5,800	5'-6"	Diesel	S-St	5'-6",13'-3",20-9"	1,100	Cruise	P&S 3 decks
COMMONWEALTH	135	28	8	432	3,200	5'-4"	Diesel	S-St	4',12',19'7"	600		P&S 3 dedks
BAY STATE	110	28	7	308	2,600	3'-9"	Diesel	S-St	3',11'19'	500		P&S 3 decks
GEORGE'S ISLAND	90	28	6	216		4'-2"	Diesel	S-St	4',11'	370		P&S 2 decks
EDWARD ROWE SNOW	65	24	6	134	880	3'-4"	Diesel	S-St		200		
BOSTONIAN II	62	18.3	6.8	110	740	3'-4"	Diesel	S-St		190		
VINEYARD SPRAY							Diesel	C_				
NAUSHON	213	60	14.2	1,643			Steam	S-St				
MASSACHUSETTS BAY LINES, INC.												
FREEDOM	100	42	5	300		4.5'	Diesel	C-Al		375		
NEW BOSTON	90	28	5	180		3.5'	Diesel	S-St		450		
NANTASCOT	65	28	5	130	1,200	3.5'	Diesel	S-St		250		
VINEYARD QUEEN	60	18.3	7.4	116			Diesel	S-Wd		149		
GRACIOUS LADY	65	21	5	98			Diesel	S-Al		149		
MARTHAS VINEYARD												
SEA BREEZE							Diesel					
MASSACHUSETTS							Diesel			350		
A C CRUISE LINES												
VIRGINIA C, II	90	24	6	185		4'	Diesel	S-Wd	4'	215	Cruise	Side
CAPE ANN	116	26	7	302		3'	Diesel	S-St	3", 10'-4"	550	Cruise	Side
MARINA BAY COMMUTER LINES												
INDEPENDENCE	75	18.5	5	99		5'-2"	Diesel	S-Al	5'-2"	134	Cr/C/S	P&S 1 deck
LIBERTY	75	21	5	113				S-Al		149		
VICTORY												
BOSTON HARBOR COMMUTER SERVICE												
STERLING	100	27	6	231				S-Al		149		
CHIMERA	100	22	6	189				S-Sl		149		
DRAGONFISH	100	22	6	189				S-Al		149		
CAPTAIN RED	90	22	6	170				S-Al		149		
ROWES	40			0								
FOSTER	40											
MAJESTIC	100			0								
LOGAN	40											
CAJUN EXPRESS												
THE SPIRIT IV ASSOCIATES												
SPIRIT OF BOSTON	145	33	6	410		4'	Diesel	S-St	4', 12'-6"	600	Cruise	Aft
CAREFREE CRUISES, INC.												
SANS SOUCI	75	22	4.5	141			Diesel	S-Al				
SEA EXPLORER CRUISES, INC.												

VESSEL CHARACTERISTICS

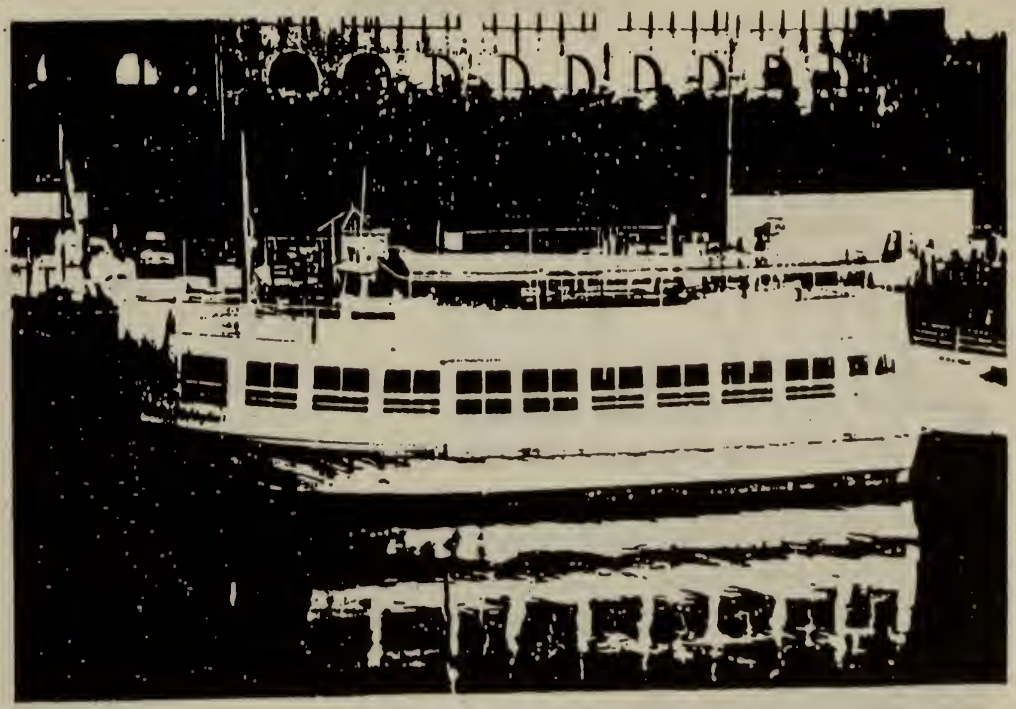
SEA EXPLORER	45	12	3	23		Diesel	S-Wd	3'-6"	49	
BOSTON PARTY BOATS, INC.										
BARBARA M.	40	12	3	21			S-Wd		49	
MISS ATLANTIC	40	12	3	21			S-Wd		49	
CAPTAIN LOU, INC.										
KING PHILLIP	40	16	3	27					49	
NEW ENGLAND AQUARIUM										
VOYAGER	90	24	6	185					149	
BOSTON WATERBUS SERVICES, INC.										
KNOTTS ISLAND	72	27	4.5	125		Diesel	S-St	3'-6"	149 + 8 Vehicles	
AMBIANCE YACHT CHARTERS										
AMBIANCE	120	25	9	386		Diesel	S-St	10'	149	Cr/Con
BASS POINT CRUISE LINES										
TRAVELER	45	12.5	4.5	36		2 Diesel	S-Wd	3'	49	Cruise Side-Port
M & M MARINE										
CORDELIA	45	13	4.5	38	4'	Diesel	S-Wd		49	Cr/Fish
OTHER OWNER/OPERATORS										
COMMODORE HULL				0						Cruise Side
PILGRIM IV	47			0						
EILEEN C.	45	16	3.75	39	4'	Diesel	S-St	7'	45	Crew shuttle:Side
CAPT. JOSEPH										



FREDERICK L. NOLAN JR.

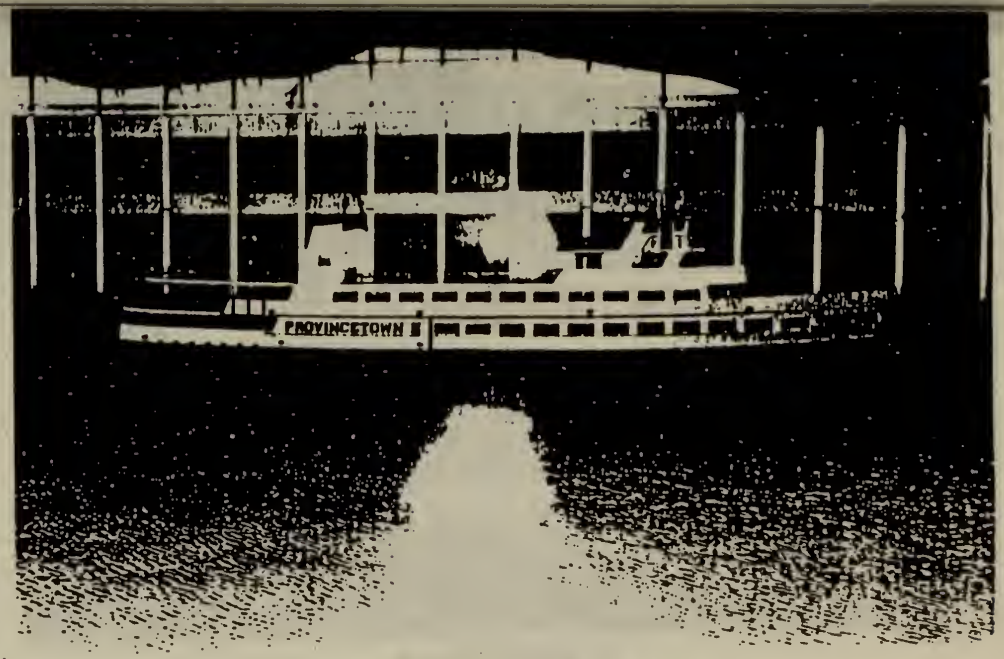
FORT INDEPENDENCE

FORT WARREN

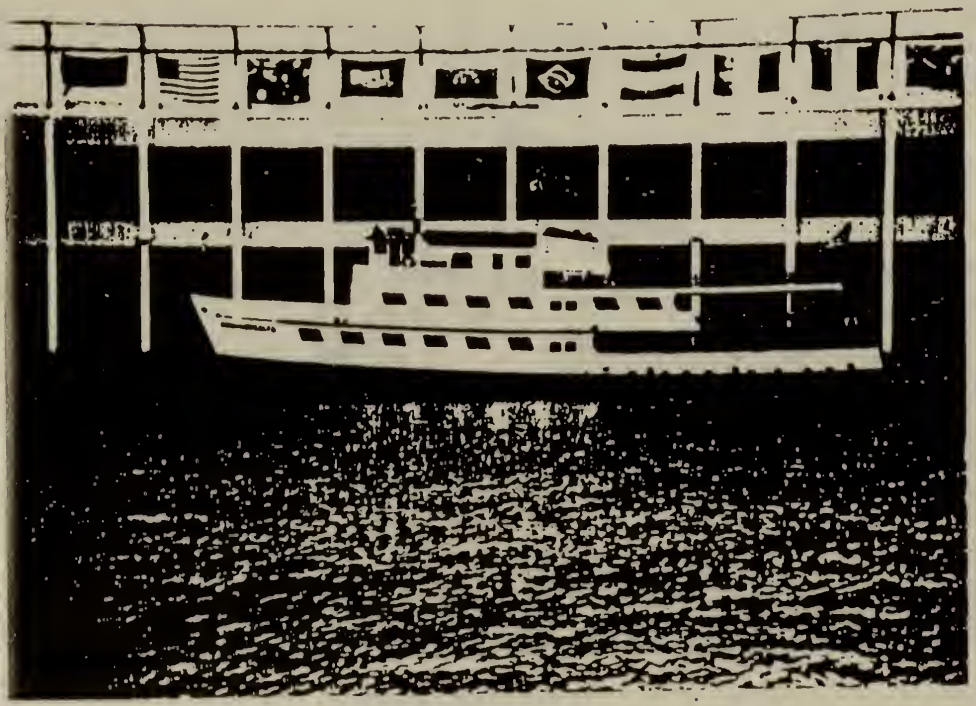


MARTHA WASHINGTON

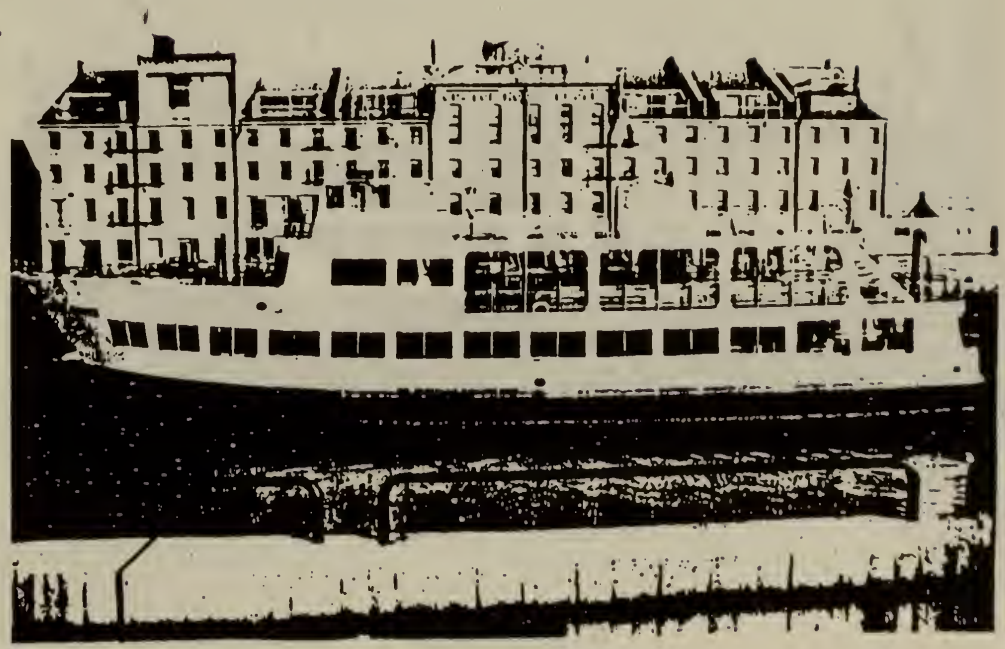
ABIGAIL ADAMS



PROVINCETOWN II



COMMONWEALTH



BAY STATE

EDWARD ROWE SNOW

BOSTONIAN II

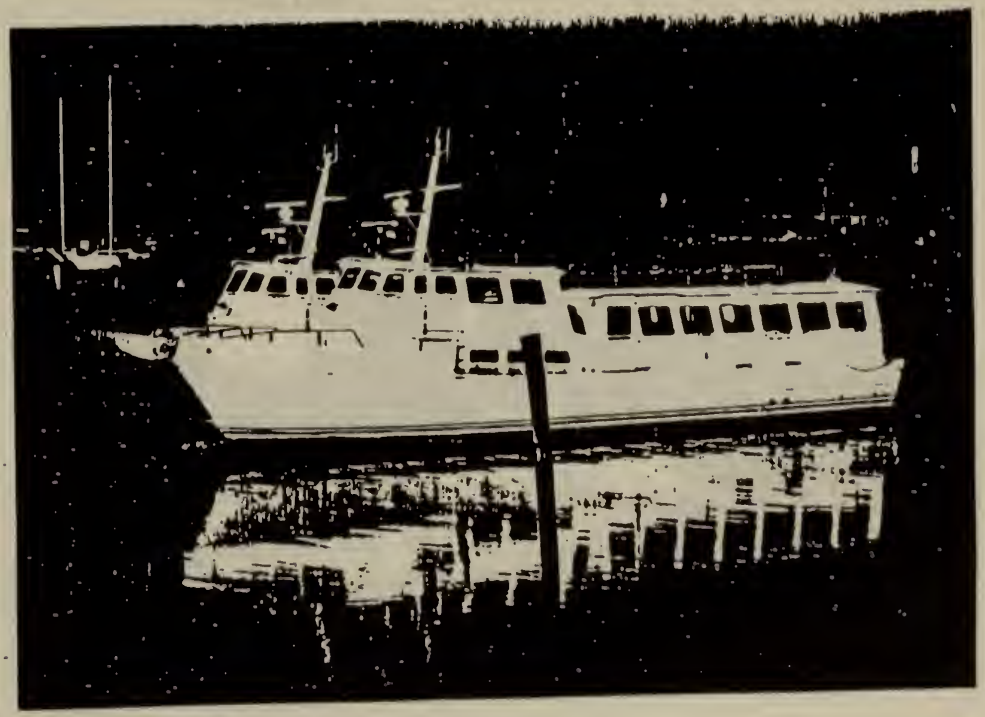
NEW BOSTON

NANTASCOT

MARTHAS VINEYARD

SEABREEZE

VIRGINIA C II



LIBERTY

INDEPENDENCE

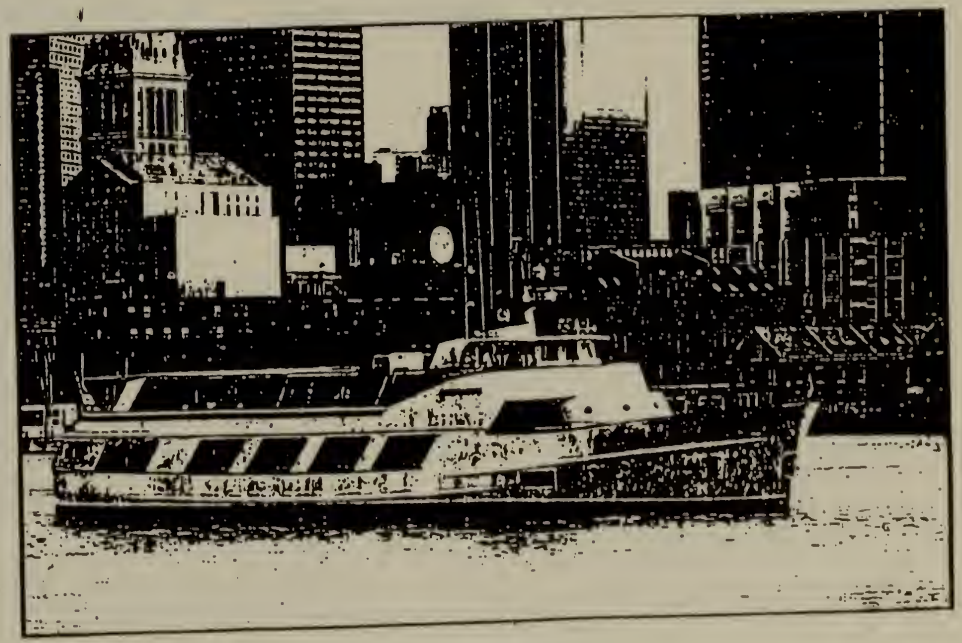
LIBERTY

INDEPENDENCE

FOSTER

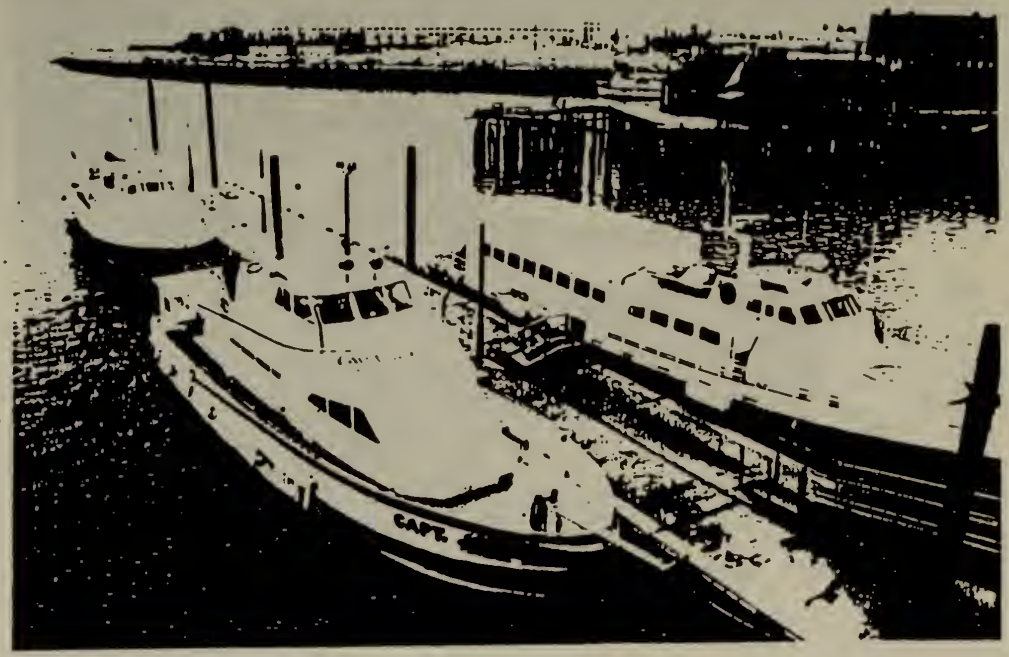
ROWES

SPIRIT OF BOSTON



AMBIANCE

COMMODORE HULL



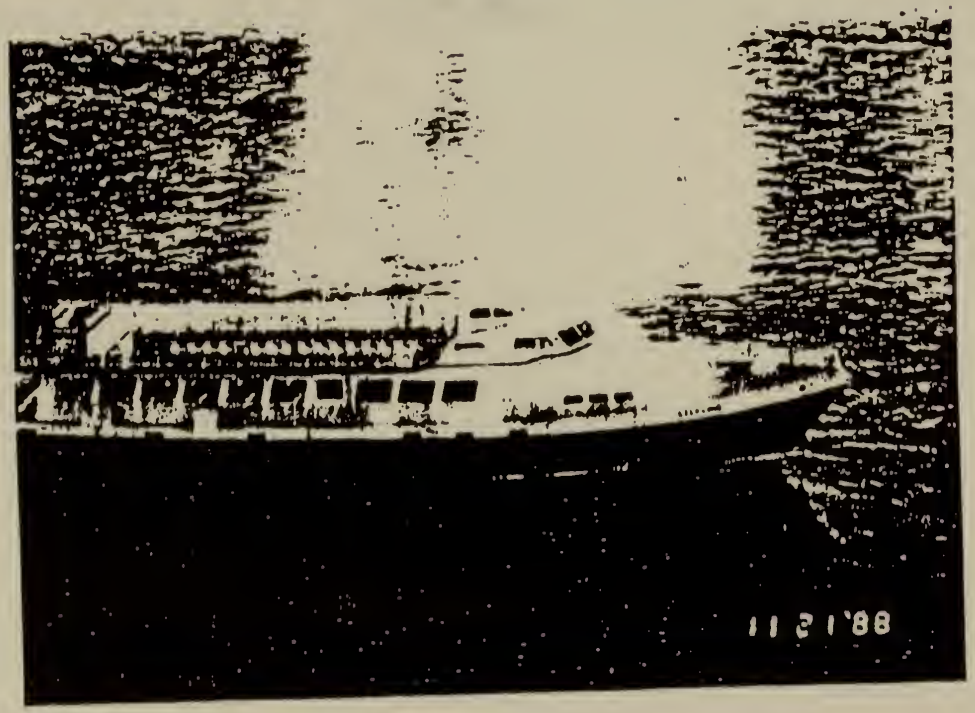
DRAGONFISH

CHIMERA

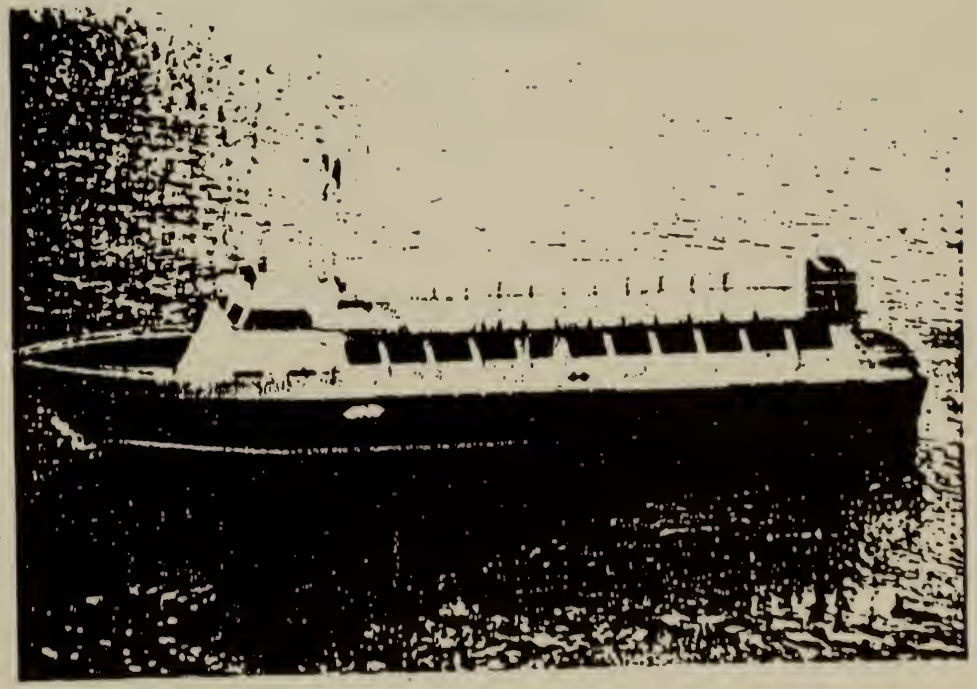
CAPT. JOSEPH

MAJESTIC

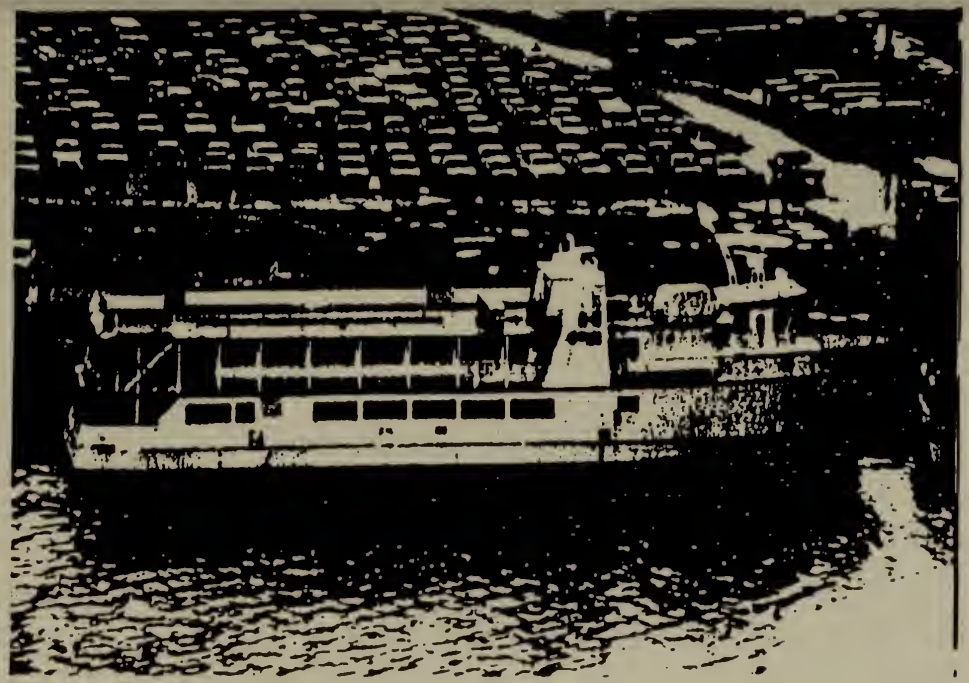
GRACIOUS LADY



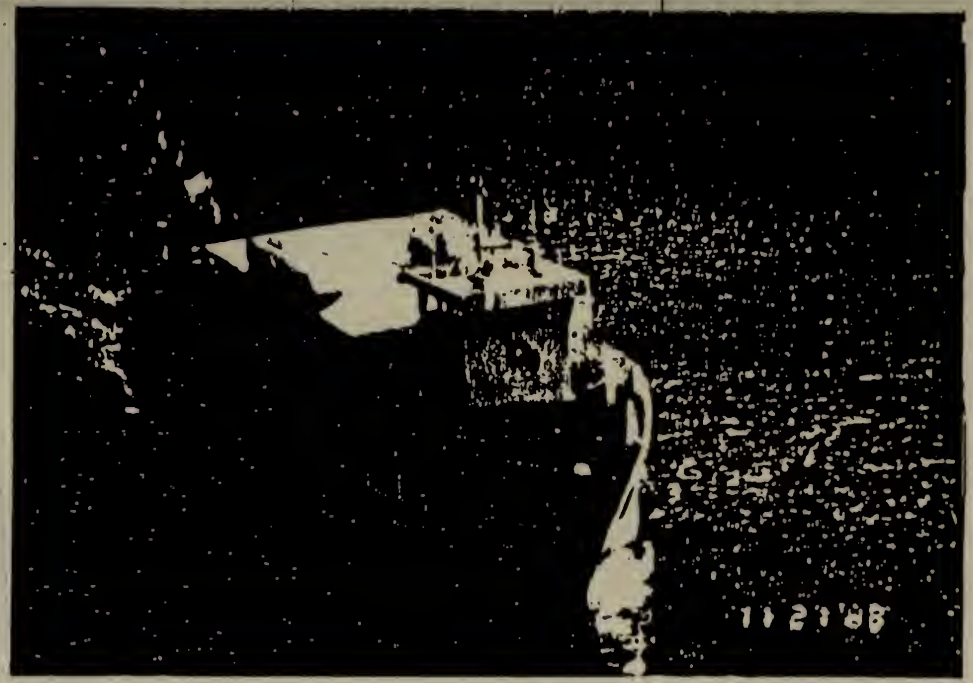
STERLING



CAJUN EXPRESS



CAPE ANN



MASSACHUSETTS

APPENDIX 3

REPORT ON HARBOR PHYSIOGRAPHY

WTR1/06.RPT
020989/3

WATER USE PLANNING - BOSTON HARBOR

By: Maurice Freedman, P.E., FASCE
Varoujan Hagopian, ASCE

I. Introduction

Boston's urban waterfront development is at a unique juncture in history. The heavy industrial and rail/shipping transportation uses of the late nineteenth and early twentieth centuries have all but collapsed. Rotting piles and sheds and abandoned weed and rat infested rail yards give mute testimony to this earlier, once thriving era. However, small, but vital enclaves of the traditional working waterfront still remain. The newer technology of containerized cargo shows slight, but uncertain evidence of turning around the more than century-old trend of declining shipping tonnage.

Under pressure for new urban residential and commercial space in the last decade or so, underutilized and vacant prime waterfront properties have become subject to a new trend. This had been the growth of luxury office, residential and commercial/retail uses, unrelated to the functional aspects of a waterside location, but capitalizing on its vista and excitement. In addition, new access and recreational facilities have brought the public in increasing numbers to the water's edge.

During this same period, pollution abatement as mandated by the 1972 Clean Water Act (PL 92-500) has lagged woefully, leading Boston Harbor to earn "the dubious distinction of being one of the most polluted in the country - if not the very worst".[1] However, growing public use generated concerns leading to federal court and EPA intervention and the recent creation of the Massachusetts Water Resources Authority with its commitment for a multi-billion dollar harbor clean-up. While long overdue, the accomplishment of this program will further increase the attractiveness of the waterfront and its quality of life.

While at first well received by urban citizens who recognized the benefit of replacing decayed and derelict land areas by sound and viable new development, questions have begun to emerge about where this revitalization should occur and what priorities should be established for water dependent and non-water dependent uses on our waterfronts. Where the "success" of this new development has been most evident, tensions and conflicts have begun to emerge between proponents of the new growth and those committed to protecting the harbor resource for present and future opportunities of the working waterfront. In a sense, this is a clash of visions. On one side are those who believe traditional maritime activities are declining

---

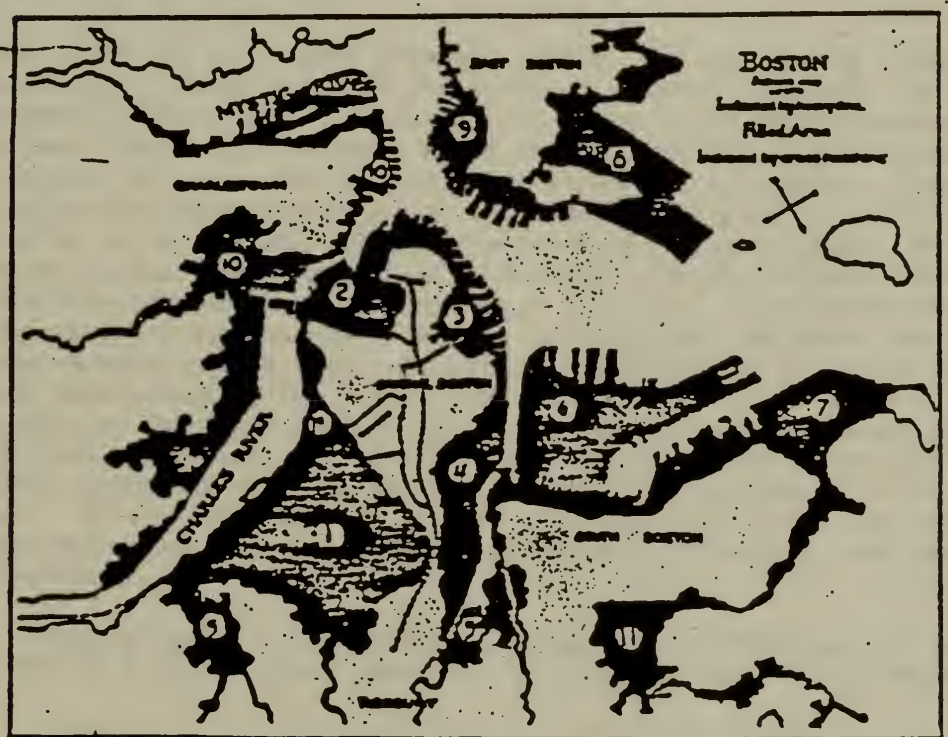
1. The Boston Globe Supplement, Changing Tides, November 3, 1985, p. 25

irreversibly and see no special value in preserving water access. On the other side are those who hold the broader vision that new forms of maritime activity and waterbourne transporation are emerging, and while they are willing to accommodate new private development, wish to assure public access to the water's edge and preservation of unique navigational opportunities for future generations.

II. Legal Basis for Public Interest

Starting with Justinian law of ancient Rome, continuing through English common law and reflected in the maritime ordinances of the new colonies, this commitment to the broader vision of public access, by all, to the shores and water highways of the world has been stated recently in Coastal Zone Management (CZM) policies of the federal government and adopted by almost all coastal states including Massachusetts.

In addition, the recently enacted state statute, Chapter 91 clearly establishes the legal basis for preservation of these public access and common maritime interests on those lands which are formerly filled Commonwealth tidelands, which is most of Boston's urban waterfront (see Figure 1). Therefore, this broad vision for the future is legally supported, but the question remains: how and where should market generated new development be accommodated on the waterfront while preserving opportunities for public access and maritime commerce?



HARBOR ANALYSIS BOSTON, MASS
FORMERLY COMMONWEALTH FILLED TIDELANDS

FIGURE 1

III. Harbor Planning Process

In order to address these questions and provide a rational basis to resolve the identified conflicts, it is the suggestion of the author that we establish an analysis and planning methodology unique to the harbor environment. But before exploring this, let's examine what has been done in land use planning to see how this can be applied to the specialized conditions of the waterfront.

In land use planning over the past fifty years or so, techniques have been formulated and widely accepted to objectively analyze the resource characteristics of land by such categories as: soil and geology, slopes, vegetation, drainage, views, etc. The well-known landscape architect, Ian McHarg, established a technique by which these land resource attributes could be overlayed to establish a graphic composite delineating zones most appropriate for various categories of development. For instance, it is obvious that remote land with steep slopes and ledge would not be an area appropriate for development of industrial buildings, but flat land near prime transportation would be. In effect, we have grown to understand land characteristics differentially, based on resource qualities and this has guided land planning policies and practice.

However, in an urban harbor, when we stand at the water's edge and peer seaward, we tend to view the water surface as undifferentiated, having no distinct resource characteristics, and, therefore, see no particular rationale for planning and prioritizing new and potential uses. Indeed the prevalent attitude on the part of many, towards the miles and miles of presently available harbor edge is that "there is water to burn".

This could not be further from the truth! In fact, if we study and classify the water areas of our harbors, we will find that the use potentials are highly differentiated, based on objective resource characteristics of the water areas and its ability to accommodate the needs of ships, boats, and other vessels. In addition, once we have rationalized priorites for water use, this must in turn be related to appropriate land side activities and uses along the harbor's edge. Then, through an iterative process, we must reconcile conflicts between water and land uses to assure consistency and compatibility between them; thereby establishing the basis for a comprehensive harbor plan. Relevant considerations of harbor edge land uses relate on one side to the water uses described above, and in turn to the urban fabric, adjacent neighborhoods, transportation arteries, community priorities, market and political forces and the entire litany of well established factors that influence inland uses. In addition, special water's edge considerations such as: water-dependent, water enhanced and non-water dependent uses must be prioritized.

In order to create a rationale for prioritizing water use, we must establish a vessel classification and resource evaluation system

most appropriate to the water environment. The relationship of vessel and resource characteristics establishes an objective accommodation methodology and illustrates the special aspects of water use planning. This will be discussed in the following sections.

IV. Emerging Waterborne Activities

Boston is currently having second thoughts about the future of its harbor, where development has not been guided as well as it might. In Boston Harbor, we are beginning to realize that we don't have "water to burn". An important part of the recently unveiled Harborpark Master Plan and the Harbor Park Commission established by the City of Boston is to create a balanced waterfront and to preserve the unique harbor resource for future generations. This planning will take into account new types and levels of activity and pressure on the harbor.

Boston Harbor is currently the focus of new maritime activity in the form of LNG tankers, containerized cargo ships and bulk cargo vessels. These activities are a clear and welcome reversal of a steady decline that dates all the way back to the depression of 1857. A capsule summary of the historic evolution of Boston Harbor can be scaled in relation to its prime pier, Long Wharf, whose activities have been a barometer of port activities (see Table 1).

Growth in the commercial activities of the Port of Boston has been accompanied by a much more dramatic growth in new forms of recreational and small-scale commercial harbor activity; boats offering harbor and island tours, commuter boats, and a rapidly expanding fleet of private yachts and boats, as well as other harbor small craft. John Case has indicated that waterborne trips in Boston Harbor is presently approximately 300,000 annually, while Vancouver, B.C. (whose regional population is smaller than Boston) has over 2,500,000 trips per year. When one examines the configuration of Boston Harbor and the heavy population along its shores, it is easy to envision a manyfold increase in trips if attractive, safe and convenient waterborne transportation is provided.

It has been identified that over one hundred governmental jurisdictions are responsible for the regulation of Boston Harbor. This has been a critical flaw in comprehensively addressing harborwide issues. However, the Commonwealth, acting in concert with the City of Boston, has recently taken a number of strong leadership steps to address overall harbor issues.

Governor Dukakis has issued a Waterborne Transportation Policy that is being implemented through the Executive Office of Transportation and Construction (EOTC) and MassPort (a quasi state authority). Under guidance of the Governor, Commissioners James Gutensohn (Department of Environmental Management - DEM) and William Geary (Metropolitan District Commission - MDC) are currently creating the

TABLE 1

Historic Time Chart / Long Wharf

Era	Century	Year	Historic Events	Long Wharf Events	Maritime Trade & Commerce
SHAWMUT INDIAN	15th	1492	Columbus discovers Watling Island		INDIAN CANOES
	16th	1524	Verazzano discovers New York Harbor		
		1565	1st Settlement on continent, St. Augustine FL		
decimated by imported plague	17th	1602	Capt. Gosnold discovers Cape Cod		
		1620	Pilgrims land at Plymouth		
		1630	Boston settled by Gov. Winthrop		
RURAL SETTLEMENT BY EUROPEANS & TRADE EXPANSION		1673		Barricade constructed	GROWING COLONIAL TRADE USING MUD BERTHED VESSELS
		1691	Mass Bay Colony combines with Plymouth & Islands		
	18th	1712		2200' wharf constructed	
		1713	"Peace of Utrecht" initiates stability & rapid trade growth	1st landing of Crown Troops	
		1763		Wharf widened	GROWING PRESTIGE TRADE ERA OF HIGHLY VALUED COCOA, TEA, SPICES, MACHINERY, & EUROPEAN HARD GOODS
		1776	U.S. Revolution	Evacuation of Gen. Gage & Crown Troops	
TRADE MATURATION, FINANCE & CITY BUILDING	19th	1824		Wharf tip enlarged	
		1832	Railroad Era begins	Locomotive "Meteor" off-loaded	
		1839	Clipper Ship Era begins		
		1847		Wharf enlarged to present size	
		1857	Great Depression		
		1865	Civil War,		
		1872	Steamship Era begins		
			Boston Fire		
INDUSTRIAL GROWTH & URBAN DECAY		1889		United Fruit sheds constructed	DECLINING TRADE ERA WITH CARGOES SHIFTING TO LOW VALUE FISH, FRUIT, & PERISHABLES
	20th	1903		Boston elevated RR tunnel under wharf	
		1918	WWI ends		
		1929	Great Depression		
		1945	WW II ends		
		1956	Freeway Era begins		
		1960	BRA-Waterfront Urban Renewal starts	United Fruit sheds demolished	
RENEWAL		1976	Bi-Centennial		NEW GROWING ERA OF TOUR, COMMUTER BOATS & PUBLIC USE OF WHARF
		1985		Wharf reconstructed	

Boston Harbor Islands State Park. This consists of a string of twelve major islands stretching eight miles out to sea, which will be made accessible to all citizens through a system of ferries connecting to land terminals, including a key facility at downtown Boston's Long Wharf which connects directly to mass transit.

Even the National Park Service (NPS) of the federal government is getting into the act; constructing piers at the Charlestown Navy Yard Historic Site (which includes the U.S.S. Constitution) and the Kennedy Library in South Boston. MassPort has constructed a new pier with a shuttle bus link at Logan Airport, with ferry service to and from the downtown and has acquired a series of East Boston Piers to preserve this important waterfront area for maritime commerce and deep water shipping (even though these facilties have no designated current use). In addition, M.G.L. Ch. 91 established "Designated Port Areas" which encourages Maritime Industrial activities by giving permit and public funding priorities to those specific areas. Figure 2 shows Arteries of Waterborne Transportation and some of the rapidly increasing water activities and uses discussed above.

V. Navigation Safety & Harborcraft Characteristics

The vessels which regularly ply Boston's harbor waters range from LNG tankers of almost 80,000 gross tons and 820 feet long, through dry bulk carriers of 30,000 tons and passenger liners/cruise ships of 20,000 tons down through commuter and tour boats to small day sailers and motor boats and with just about everything in between. The characteristics of these ships and boats has been charted as to category, activity, functions, maximum wave exposure that can be endured when secured to fixed piers, dimensional factors and compatible land side use. This information is summarized in Table 2.

Table 2

Harborcraft Characteristics

Vessel Category	Activity Requirement	Activity Level	Max. Wave Exposure	Min. Water Depth	Max. Length of Vessel	Vertical Clearance	Related Land Use
Large Commercial	year-round 24-hours	moderate	6' - 8'	35'	820'	125'	heavy industry
Military ships	year-round 24 hours	moderate	5' - 6'	25'	600'	125'	heavy industry
Tug boats working & security craft	year round 24 hours	high	3'	10'	80'	40'	light industry
Commercial fishing	year-round 24-hours	moderate	3'	8'	100'	40'	heavy industry
Commuter boats	year-round Mon-Fri.	high in peaks	2'	6' - 8'	80'	40'	commercial
Harbor & Island Tour boats	seasonal evenings & weekends	high - seasonal	2'	8' - 10'	120'	40'	commercial
Pleasure Craft (med & lge)	seasonal evenings & weekends	high - seasonal	1'	6' - 8'	25' - 80'	60'	commercial residential
Pleasure Craft (small)	seasonal evenings	moderate seasonal	1/2'	2' - 3'	10' - 25'	15'	commercial residential
Service Barges	almost - mostly stationary	very low	3' - 4'	10'	100'	40'	light industrial

HARBOR ANALYSIS BOSTON, MASS.
ARTERIES OF WATERBORNE TRANSPORTATION

FIGURE 2

1. THE LONGEST FETCH IS GLE SE
HIGHEST WIND FROM SE = 60 MPH (BSOC)
60 MPH WIND = HURRICANE (BEAUFORT SCALE)
$F_G = \frac{4.26 \cos\alpha}{60 \cos\alpha^2} \frac{(7.89)}{(4.85)^2} = 1.85$ N.M.LE.
$F_G = 1.85 \text{ N.M.} / 6076 \frac{FT}{N.M.} = 7170$ FEET
AVE. DEPTH = 35'
FROM CERC FIGURE 3.23
H = 4.5' @ T = 4.0 SEC.

2. WIND FROM S = 47 MPH (BSOB)
H = 1.5' @ T = 2.0 SEC.

3. WIND FROM ENE = 73 MPH (BS47)
H = 2.0' @ T = 2.5 SEC.

4. WIND FROM SE AT 60 MPH
WHOLE GALE
H = 3.5' @ T = 3.5 SEC.

NAVIGATIONAL CHANNEL (DEEP WATER) — 35' DEEP
INTERMEDIATE WATER DEPTH — 15' – 35'
SHALLOW WATER DEPTH — 5' – 15'

α°	Cos α	Xi	XiCos α
48	.669	.45	0.30
42	.743	.55	0.41
36	.809	.62	0.50
30	.866	.90	0.78
24	.914	.86	0.79
18	.951	1.07	1.02
12	.978	1.38	1.35
6	.995	1.93	1.92
0	1.00	4.24	4.24
6	.995	3.28	3.26
12	.978	.86	0.84
18	.951	.44	0.83
24	.914	.46	0.41
30	.866	.48	0.42
36	.809	.34	0.28
42	.743	.31	0.23
48	.669	.31	0.21
TOTAL	14.65		17.59

HARBOR ANALYSIS BOSTON, MASS.
HARBOR BATHYMETRY & FETCH TO LONG WHARF

FIGURE 3

Large Ships in the 10,000 to 30,000 gross ton category often make harbor passages unassisted, and use tugboats only for docking. These large, professionally-operated craft, which might take over one-half mile to stop or turn and with highly restricted forward visibility from the bridge, operate in narrowly confined, deep water channels (see Figure 3). When these ships are unexpectedly mixed with "sunday sailers" tacking under their bows in small sail boats or darting about in motor-boats (all but oblivious to the hazard they are creating), maritime safety is seriously jeopardized. With the recent increase in small boat activity, these near misses are creating needless anxiety in the lives of harbor pilots.

Our first consideration in harbor planning should, therefore, be to establish "approach-zones" at small craft harbors or marinas that are as clear of main ship channels or approaches to commercial docks as possible. The maximum possible separation between entrances to new small boat basins and existing marinas and docks for large ships and other working vessels should be a part of harbor planning policy and adherence to this encouraged by permit regulation. In addition, education for harbor safety of the boating public through yacht, sail and boat club programs and the U.S. Power Squadron requires continuing attention. Side channels with shallow depths inappropriate for large ships, should be designated as fairways for small craft on NOAA charts. Separation zones for outbound and inbound commercial traffic are already a fact of life at large ports like New York, but careful segregation of inner harbor traffic will also be required in confined harbors such as Boston as harborcraft congestion increases. This separation must be planned into new facilities before it is too late!

VI. Harbor-Water Use Analysis

A. Physiography

With its natural breakwater of the Brewsters and other off-shore harbor islands, and the seaward extending protective pincer-like arms of Long and Deer Islands, the well-protected deep water harbor of Boston has, for centuries, beckoned to mariners (see Figures 2 and 3). In the earliest period of settlement, its shape, winds and tides provided ungainly square-rigged ships an easy approach to the land-locked town landing and ready access by small boat parties to the interior of the colony by the water highways of the Charles and Mystic Rivers. Located close to the great circle sea route between the North American east coast and Europe, Boston is in a strategic location which contributed greatly to its commercial growth during the first two centuries of its history. Boston Harbor is also an estuary and with construction of tidal dams on the Charles and Mystic Rivers just above the inner harbor in the early and mid-twentieth century respectively, its inland penetrating salt waters was blocked at these locations. These dams are major civil engineering structures, creating permanent pools above them, and enormously enhancing property values along their shores. Locks for tugs,

barges and pleasure craft are provided for navigation through the tidal dams. A third and smaller river, the Neponset, still discharges unimpeded, into Dorchester Bay.

The decline of maritime commerce in the mid-nineteenth century has also coincided with major filling of portions of the harbor and today its water areas are but a small fraction of their original extent (Figure 1). At present, when a large vessel enters Boston Harbor, it proceeds inland via a relatively confined deep water channel to docks along South or East Boston or piers or bulkheads up the Mystic River or Chelsea Creek. Many of the previously active piers along the deepwater channel in the downtown and East Boston and on the Charlestown waterfront have fallen into disuse.

B. Bathymetry and Tides

Deepwater navigation (up to 35' at mean low water) is provided up to the Charlestown, Chelsea, and East Boston shores (see Figure 3). The predicted tide range in Boston Harbor ranges from 8' to 14' and storm tides have been noted some four or five feet above this in extreme conditions every 5 or 10 years or so, lapping at downtown Atlantic Avenue at Long Wharf (elevation 12+ NGVD). The mean sea level has risen approximately one-quarter foot in the past 50 years and there is concern that continued sea level rise will create flooding problems in the downtown.[2] While siltation rates in the harbor did not materially increase after construction of the tidal dams, as had been feared, [3] maintenance dredging of the main channels is required on a five to ten year cycle and some downtown pier areas have silted 10 to 15 feet in the past 50 years or so making them unuseable.[4]

Harbor flushing to ensure scour to maintain navigable depths naturally and to remove sewage wastes and other pollutants have been expressed concerns of Boston's citizens since the mid-nineteenth century. State tidelands licenses, in the past century or so, have penalized "filling of the tidal prism" a recently acknowledged environmental concern in San Francisco Bay and other harbors. Currents in Boston Harbor are generally quite modest, being only 2 knots or so at the entrance at Deer Island Light and generally one knot or less in the channels of the inner harbor and its branches.[5]

Ice conditions in Boston Harbor is generally minimal in deep water locations, but it does freeze annually in shallow areas with less than depths of 10 feet or so. Shipping is easily

---

2. The Boston Globe, Ibid, p. 28
3. Report on Charles River Dam, John C. Freeman - 1908
4. Upland Dredged Material Disposal Site Analysis - Sasaki Assoc., Inc. Apr. 1983
5. Current Charts of Boston Harbor - NOAA

conducted on a year round basis, however, as dramatically recorded in a famous old etching, Boston harbor did freeze solid in the 1870's. Sheet ice moving with the current and ice uplift on timber pilings in shallow areas are occasional problems.

C. Meterology and Wave Energy

With a Class "A" weather station at Logan Airport at the entrance to Boston's inner Harbor, excellent meteorological data is available, but considerable judgment is required in using this historic information to project a realistic assessment of harbor conditions, its wind environment and wave climate. The great arm of Cape Cod extends seaward over sixty miles to the south and east, protecting Boston's offshore Massachusetts Bay somewhat from the stongest hurricane winds which come out of the south and southeast, (dangerous semi-circle) as a hurricane passes to west of Boston. Hurricanes passing to the east generate northeast and northerly winds of lesser intensity (navigable semi-circle) than those out of the south and southeast. From an inspection of Figure 4, one can see that the two most severe storms of record emanated from the south (88 mph) in the 1938 hurricane and the southeast (80 mph) in the 1950 hurricane. In both of these cases, the hurricane eye passed to the west of Boston, placing it in the right or dangerous semi-circle of greatest wind velocity.[6] It may be inferred that without the reducing friction of the Cape Cod land mass, these winds would have been even more intense. Other lesser intensity storms are also shown on this diagram.

From this diagram, it can also be seen that with seven storms greater than sixty-five miles per hour in the past 50 years, a 10-year frequency of a seventy MPH wind velocity is a reasonable assumption. From experience, we can expect at least two or three nor'easters each year, with wind velocities in excess of 50 mph, usually in the winter months. As can also be seen in Figure 4, contrasting with the extreme storms, the summer prevailing winds are from the southwest and prevailing winter winds are from the northwest.

Understanding of severe winds and their direction along with the harbor's physiography and bathymetry is necessary for calculating the "design wave" (hindcasting). Design wave is a function of the harbor water cross section (depth and width), the length of water across which the wind is blowing (fetch) and sustained wind velocity. The worst case of maximum fetch condition for the inner harbor is with wind out of the southeast (see Figure 3). The design wave is used in turn to establish loads on harbor vessels and structures. Waves breaking directly on vertical walls or bulkheads exert high dynamic pressures lasting only a few moments at a time. This occurs at the zone where the crest of the wave impacts the face of the structure. Many methods of

6. Eldridge Tide & Pilot Book - 1986.

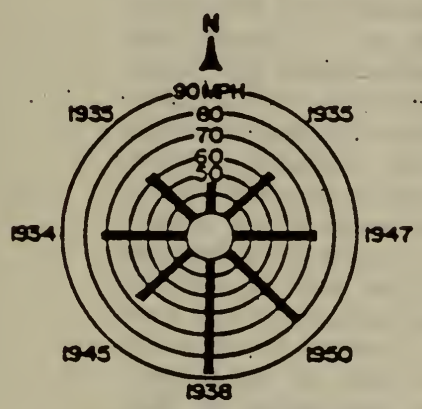
LOCAL TIDE LEVELS FOR 1985

MONTH	HIGHEST TIDE IN EACH MONTH	LOWEST TIDE IN EACH MONTH
JAN.	10.8	-1.3
FEB.	11.1	-1.7
MAR.	11.3	-1.8
APR.	11.7	-2.2
MAY	11.9	-2.2
JUN.	11.8	-1.9
JUL.	11.4	-1.4
AUG.	11.0	-1.2
SEP.	11.4	-1.6
OCT.	11.9	-2.1
NOV.	12.0	-2.3
DEC.	11.8	-2.2

ANNUAL HIGH TIDE = 13.0
ANNUAL LOW TIDE = -1.6
SPRING HIGH TIDE = 11.35
SPRING LOW TIDE = -.35
AVERAGE DAILY TIDE RANGE = 9.5'
(0.00 NGVD = +5.65 BOSTON CITY BASE – BCB)

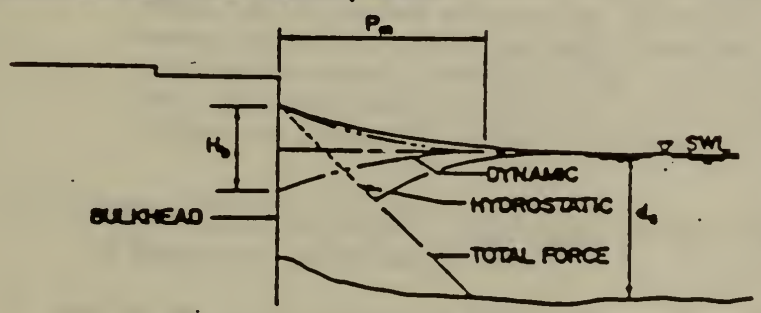
FLOOD LEVELS

FREQUENCY/YEAR	TIDE OF FLOOD	ELEVATION
1/500	500 YEAR FLOOD	11.20 NGVD = 16.85 BCB
1/100	100 " "	10.30 " = 15.95 "
1/50	50 " "	10.00 " = 15.65 "
1/10	10 " "	9.10 " = 14.75 "
1	ANNUAL EXTREME HIGH	13.1 BCB
1	ANNUAL EXTREME LOW	-1.6 "
	DAILY MEAN HIGH	+10.55 "
	DAILY MEAN LOW	1.05 "



EXTREME WINDS OF RECORD
WIND ROSE
LOGAN INTERNATIONAL AIRPORT, BOSTON

PREVAILING WIND DIRECTION



PRESSURE DIAGRAM

WAVE ENERGY (BASED ON 4.5' WAVE HT.) AT FACE OF BULKHEAD WILL VARY BETWEEN 8000 lb/FT. TO 11000 lb/FT. AND THE OVERTURNING MOMENT BETWEEN 60000 lb-ft/FT. TO 72000 lb-ft/FT.

HARBOR ANALYSIS BOSTON, MASS.
METEOROLOGICAL CONDITIONS & DATA

FIGURE **4**

analysis are available enabling the analyst to determine the magnitude of the force. One of the most common methods is the Minikin Method [7] where the maximum pressure acting on the still water level can be computed by:

$$P_m = 101W \frac{H_b}{L_D} \frac{d_s}{D} (D + d_s)$$

Where P_m is the maximum dynamic pressure, H_b is the breaker height, d_s is the depth at the toe of the structure, D is the depth one wave length in front of the structure and L_D is the wave length in water of depth D. The distribution of the dynamic pressure is shown in Figure 4. Similarly, the overturning moment about the toe is given by:

$$M_m = R_m d_s = \frac{P_m H_b d_s}{3}$$

Furthermore, the design wave can be used to assess the safety of a given vessel operating in the environment (see Table 2).

Prevailing winds are of interest in relation to vessel handling and for typical docking conditions as well as to identify locations of debris collection (opposite to prevailing winds).

The design wave is of particular significance and quite critical since its overturning force is roughly equivalent to the cube of its height.[8] In other words, a 3 foot wave has roughly three times the overturning movement of a 2 foot wave. In addition, waves within a harbor are also a product of refraction/diffraction and reflectance. Refraction causes the wave to increase in velocity and height, as occurs when a wave train contacts a promintory or convex portion of the coast. This causes an increase in energy and dangerous sea conditions at exposed headlands on the open coast, for example, which are avoided by wise sailors during storm conditions. Conversely, a wave train approaching a concave portion of the coast or a bay or indentation causes a reduction of wave energy and implies safer conditions or those of lesser energy. Hard vertical surfaces, such as bulkheads, do not reduce wave energy but merely reflect it. Rough, sloping surfaces of revetments or beaches absorb wave energy. The reflected wave from a vertical surface may damage other nearby harbor structures, therefore, sloping, rough revetment is the preferred edge treatment for effectively dealing with higher energy environments. By applying a particular design wave to harbor edge conditions, it is, therefore, possible to assess the safety of various portions of the harbor during storms.

---

7. Shore Protection Manual, Department of the Army, U.S. Army Corps of Engineers, Washington, D.C.

8. Design and Construction of Ports, Marina and Structures - Quinn D. Synthesis

Figure 5 shows, in a generalized way, four zones of wave energy which will exist during a severe storm (50 mph or more) in Boston Harbor with winds out of the east or southeast, a condition which might occur several times each year By combining wave energy considerations with bathymetric conditions (Figure 3), it is readily possible to determine best, worst and marginal locations for various harborcraft based on characteristics shown in Table 1.

If, for example, a small craft marina is to be placed in the high energy zone, wave intensity during periodic storms could cause extensive damage to boats and the floats and marine structures to which they are secured. Alternatively, a costly wave barrier would be needed at this adverse location to create a wave energy environment appropriate for the use. Similarly, locations for commuter boats and other harbor craft which are used by the public on a year-round basis should best be located in moderate or low energy locations with appropriate navigable depths to maximize safety and utility.

When we combine harbor bathymetry (Figure 3) and harbor wide energy zones (Figure 5) to analyze the shores of Boston's Inner Harbor, we find a number of extremely well protected, very low energy zones with adequate water depths for a broad category of medium to smaller harbor craft (Table 1). These vessels include working boats, such as tugs, commercial fishing, commuter and harbor tour and water taxis and pleasure craft of all sizes and types. The protected inlets consist of: Reserved and Fort Point Channels, Charles and Mystic Rivers (below their respective tidal dams), Charlestown Inlet and the Chelsea River. Charlestown Inlet is blocked by a recently constructed fixed bridge and Fort Point Channel is blocked by two inoperative draw bridges and will be permanently blocked by a fixed bridge (16 feet vertical clearance at mean high water) presently being designed by the Mass. DPW. The shores of these inlets are the best possible locations for accommodating the medium to smaller craft described above, and access to them should, therefore, be given the greatest consideration for these vital and growing water uses.

The deep water pier locations along the South Boston, Charlestown and East Boston waterfronts which are indicated as low to moderate energy zones (Figure 5) should be preserved for larger commercial and military ships, even though there is not adequate commerce for these vessels at this time. These locations are ideal for marine industrial uses and a sound vision of the future should allow for resurgence of this activity as an element to strengthen and diversify Boston's economic base. Further, the water depth and wave energy climate makes these locations hazardous and inappropriate for small boat use. If Boston is to have a future as a port, then it must plan its water uses in a way that prioritizes, respects and properly uses the harbor to accommodate present and future needs for vessels of all categories.

HIGH ENERGY ZONE	INCIDENT / WAVES	5' TO 15'	
MODERATE ENERGY ZONE	INCIDENT / WAVES	3' TO 4.5'	
LOW ENERGY ZONE	INCIDENT / WAVES	1.5' TO 3'	
VERY LOW ENERGY ZONE	INCIDENT / WAVES	0' TO 1.5'	

FOR PREVAILING WIND AND EXTREME WINDS OF RECORD SEE FIGURE 4.
FOR TYPICAL WAVE ENERGY CONDITION IN AN INNER PORTION OF THE HARBOR SEE FIGURE 6.

HARBOR ANALYSIS BOSTON, MASS.

HARBOR WIDE WAVE ENERGY ZONES

FIGURE 5

VII. Long Wharf Water Planning

Figure 6 shows in more detail the wave energy conditions for the Long Wharf area, a key locus of Boston Harbor. Shown in this figure is direction of storm wave approach and consequent refraction/diffraction patterns based on an approximate calculation method and plotted as K' factors. The K' values shown are factors by which the height of wave train approaching the wharf are proportionately modified by refraction or diffraction. At a 50 mph sustained wind from the southeast, for example, a 3 foot wave will be generated and wave crests approach as shown. Where K' = 1.1, a 3.3' wave is implied (greater than that of the approaching wave) and where K' = 0.6, a 1.8 foot high wave will occur, etc.

Therefore, it has been possible to categorize the water areas by Long Wharf and adjacent Commercial Wharf (north side) and Central Wharf (south side) as either low, intermediate or high energy. Other factors of the marine environment which must also be considered at this location are surge from passing large ships, harbor ice, and the environmental implications of dredging.

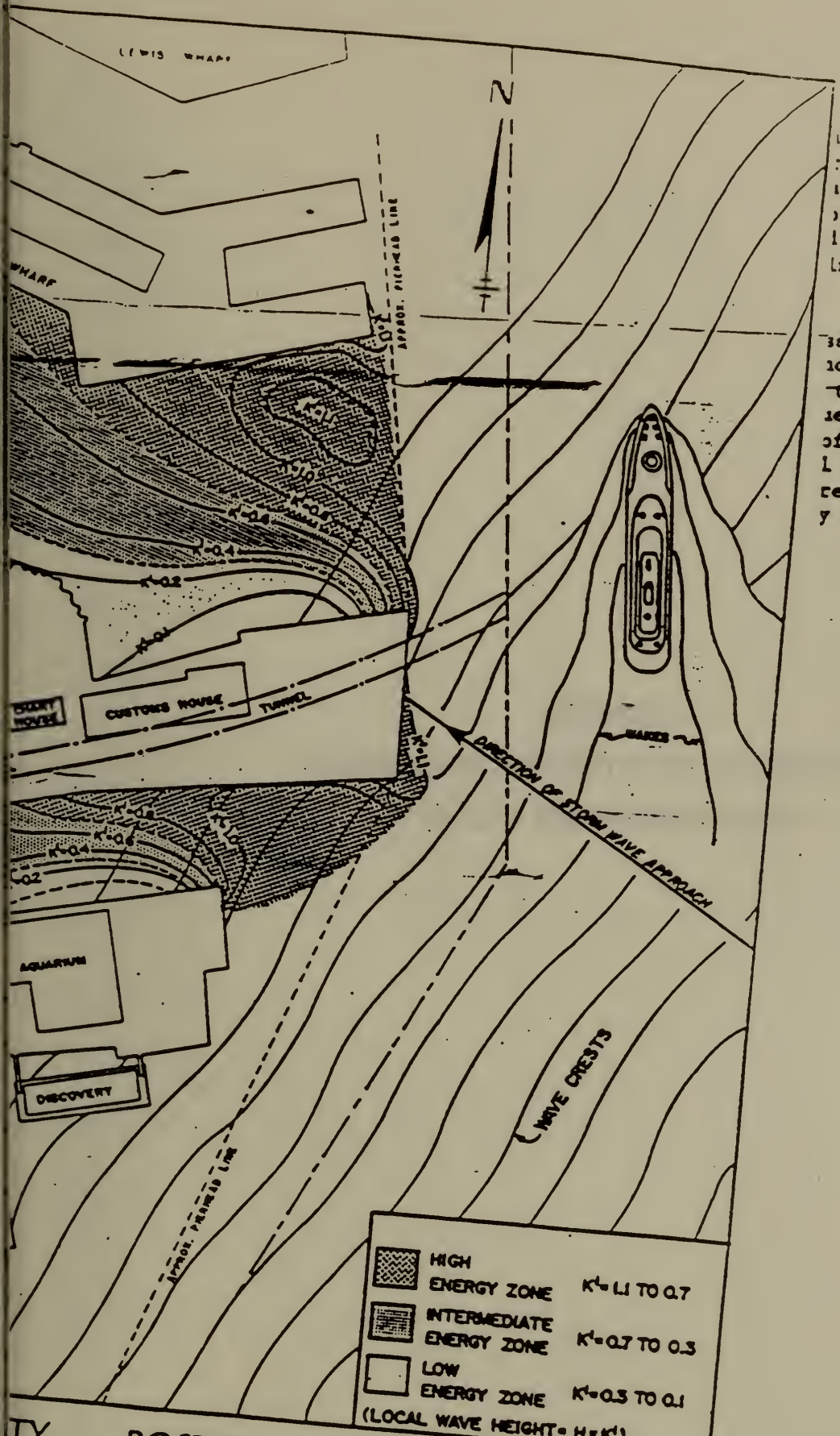
Correlating wave energy conditions with bathymetric data and landside considerations of access, loading areas, etc. priorities are being established for an array of waterbourne transportation functions which are to be accommodated at Long Wharf as part of its reconstruction by DEM/BRA as a terminal for the Harbor Islands State Park. Boating uses to be accommodated are:

- Harbor Island Ferries
- Tour and Commuter Boats
- Water Taxies
- Historic Ship
- Town Landing
- Public Boat Basin and a
- Small Boat Recreation Program

Public meetings are currently underway to resolve how the variety of water uses are to be accommodated. The detailed analysis described above is a clear example of how differentiated the water's use potential actually is and the value of this planning tool. Based on vessel classifications and the composite water use resource analysis, it will be possible to optimize the location of the various activities, thereby assuring a cost-effective location of marine structures to accommodate these vessels and to assure safe operation for them.

VII. Conclusion

The water areas of an urban harbor are a unique resource with highly variable physical conditions. The vessels which ply its waters fall into certain classifications which establish how each can best be accommodated in the harbor. By graphically delineating key water related attributes such as wind patterns, bathymetry and wave energy



TY BOSTON, MASS.
NDITIONS

FIGURE 6

icteristics, it is
:itize marine use of the
ıld emerge from a process
ɔritized water-dependent,
l uses to best satisfy
lntrinsic value of the

ɜsion and analysis of
ıor that the scenario and
to many of our urban
ıe juncture of history".
ɔf the future, it is hoped
l and preserve presently
reas of our urban
y yet unborn generations.

APPENDIX 4

DESIGN GUIDELINES FOR A FULL ACCESS SYSTEM

CHILD'S ENGINEERING STUDY

INTRODUCTION

en the Boston Redevelopment Authority and Childs Engineering Corporation
mitted. The report includes information which has been gathered in regard to:

w in use in Boston Harbor and in other harbors.

urt regarding handicapped access to vessels within Boston Harbor and in some
milar tidal ranges.

vessel handling facilities including handicapped access facilities and detailed
wing access facilities.

l tidal environment within Boston Harbor.

e and water taxis in Boston Harbor at the present time and some of the types
in the future.

S OF VESSEL ACCESS IN BOSTON HARBOR

shuttles and taxis in Boston Harbor is generally via floats from the vessel
make the actual movement from the float to the vessel. Access from the
ying in length. Where the access is directly from the pier to the float, the
he slope when operating at low tide. Where a transition height structure is
ice the amount of vertical distance which must be negotiated at low tide is
s the transition between pier and vessel. Only a few of the vessels in the
are designed to load passengers at more than one deck.

el loading. Portland, Maine and Casco Bay use direct pier to vessel load-
nd/or gangways to the vessels. Where there are no car ramps, the piers
y is lowered.

VESSEL ACCESS IN BOSTON HARBOR

- No full access (handicapped access) facilities have been provided for
or the "Edmund Fitzgerald" tugboat restaurant. There are smooth
ng enough to ensure a maximum slope of 1:12. The access to the ferry
another set of stairs or steep ramp to the vessel.

er 11 (Figure 4) - Access to the vessels at this pier is from the pier
MLW (Mean Low Water - See Environment Section in Appendix).
is assumed to be in excess of 25 feet below MLW.

gways are acceptable for width and they have the middle railing but
etimes exceed 1:12, they have no platforms at 32-foot intervals and
ir lower ends.

W. The local cruise and
se of the float's deck and
to quality as a full access
r depth at the pier face is

gle level float and a ramp
imed to be about +16 feet

from the fixed pier by one
also served by a ramp from

ith a deck house as at Com-
+14 feet above MLW. The

of these facilities use ramps

o the single level floats. The
depth at that side varies from

on fire boat facility. The fire
form to the pier deck. Access
+14 feet above MLW. Depth
LW.

for handling passengers on the
form above the pier deck and a
airs. The other side used by the
with ramps leading from a plat-
he vessel deck. There are stairs
on +15 feet above MLW. Depth

HANDICAPPED ACCESS

During the course of this study we reviewed information regarding handicapped access. We have been involved in the design or redesign of several ferry terminals in Boston Harbor and in Portland (Maine) Harbor. Tidal ranges in the two harbors are similar–maximum range of 14 feet. In both harbors we addressed the question of handicapped access as it relates to moving from the shore to the vessel. We also investigated what other operators in other harbors were doing to provide access. The following is a summary of what we were able to find.

In the design of new facilities for the Casco Bay Lines at the State Pier in Portland (Maine) Harbor several alternative types of access were considered, e.g., sloping ramps with counterweights at the outshore end which would be adjusted by winches; sloping ramps made up of a series of floats connected together and each supported at its appropriate height along the slope as the tide fell and elevators. Each was rejected by the Casco Bay Lines, the Maine Committee for Accessibility for the Handicapped or the consultants for the project. Reasons for rejection were safety, maintenance, practicality and/or cost. This project does include a car ramp for the large ferry. This ramp does provide limited handicapped access to this one vessel.

In the design of a new pier at Little Diamond Island in Casco Bay, Maine, similar investigations of different types of ramps were made. The population of Little Diamond is small and mostly made up of summer residents. There is limited power out to the pier so any type of electrical device was not practical. The cost of any type of ramp together with the limited requirement for handicapped access negated any provision for handicapped access.

No special handicapped access has been provided to the ferries which ply between Lincolnville and Islesboro, Maine because both ends of this route have ramps for motor vehicle access. The same is true of the ferry slips at Rockland, Vinalhaven and North Haven, Maine.

In other ferry slips we have observed throughout North America direct access is made from the pier to vessel by sloping ramps where the tidal range is quite small or is not provided at all.

New Orleans, Louisiana (Figures 12 and 13) - Two level access. Lower level for low stage river access, high level for high river stage access. Sloping ramps not to exceed 1:12 at either stage. Normal tide range is not significant, river stages depending upon the season of the year are important. Photos from Rob Elder of Maine Department of Transportation show the two level access building and the auto access ramp. The auto access ramp is for the larger ferries going between New Orleans and Gretna. A passenger access building serves the smaller ferries going to the same place but not handling autos. There is no charge for the passenger ferry.

Buffalo, New York (Figures 14 through 19) - Lake Erie at the Buffalo end may have a change in water level of several feet when the wind blows strongly. The photos from Richard Hayden Co., Inc. of Aurora, NY show a ramp and gangway system leading to a vessel loading ramp which provides for full access. The fixed pier slopes down about three feet at 1:12. There are two gangways leading from the pier to the float. When the lake is low, the access to the float is down to the lower gangway which never exceeds 1:12. When the lake is high, the uppergangway is used. Evidently this marina is used by several handicapped persons.

Hartford, Connecticut - CEC's new design uses a sloping ramp with at least two places for a gangway leading to a vessel. The Connecticut River at this point is not tidal and only subject to some mild variation in level. Nevertheless, this sloping pier with gangways at several multiple levels seems to have possibilities for full access.

Hamilton, Bermuda (Figures 20 through 23). The tidal range is small (6 feet) and so no special ramps are provided. The ferries carry their own gangways which are lowered against a steep sloping ramp built into the pier. Stairs are at either side of the ramp for use in loading the small boats which do not carry their own gangways. Even

[illegible] tidal range, the access to the ferry at low tide when the maximum amount of the steep ramp must be [illegible]ed would be difficult for a wheelchair. The passenger gangways also are used to provide access for bicycles [illegible]peds.

[illegible]apped access at most places in Boston Harbor is generally by long ramps which are usually sloping less than [illegible]t which become too steep at low tide. Access for the Provincetown II is interesting. A ramp from the pier to [illegible]ne of two positions aboard a float, i.e., on the float deck or on the flat roof of the deck house to either the [illegible] second deck of the vessel enables the operators to keep the ramp slope within acceptable limits.

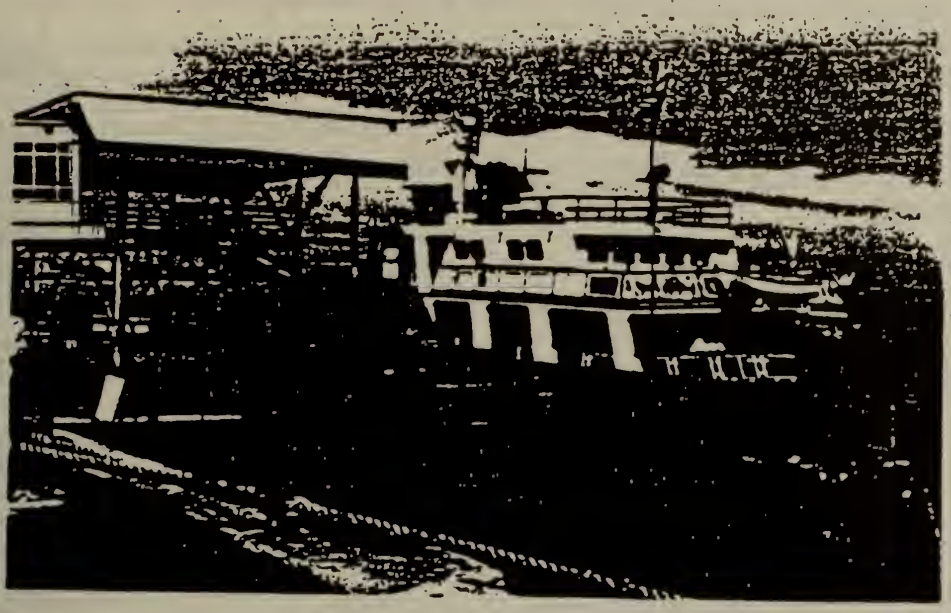


FIGURE 12 - PASSENGER LOADING FACILITY IN NEW ORLEANS. NOTE LEVEL ABOVE PIER DECK ELEVATION (UNDER CANOPY BEHIND LARGE RED DOLPHIN).

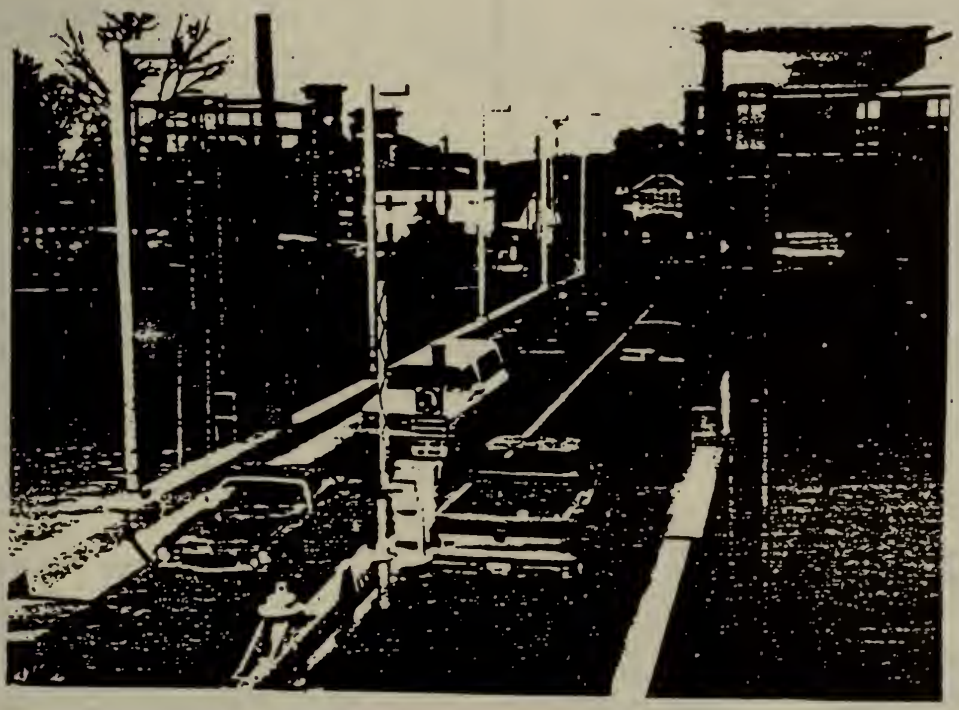
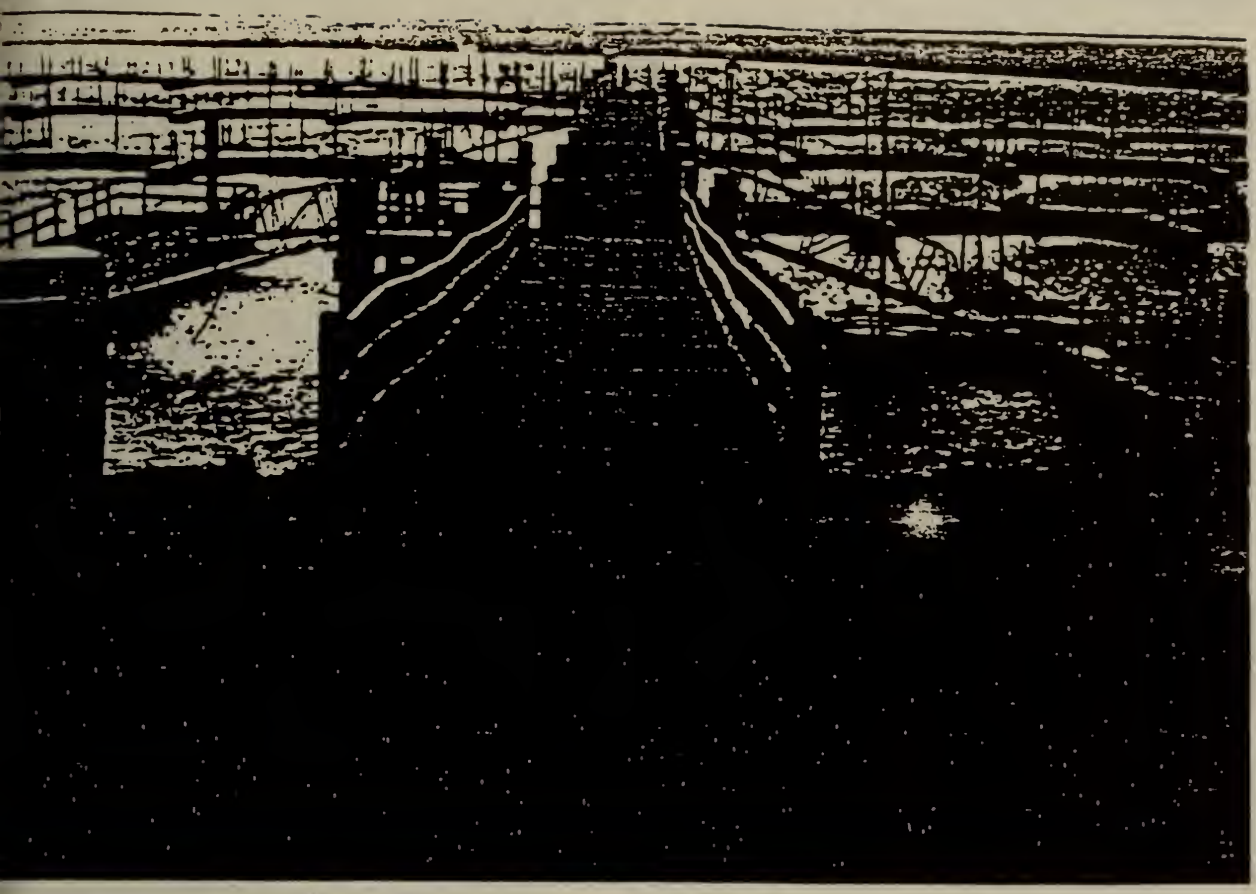
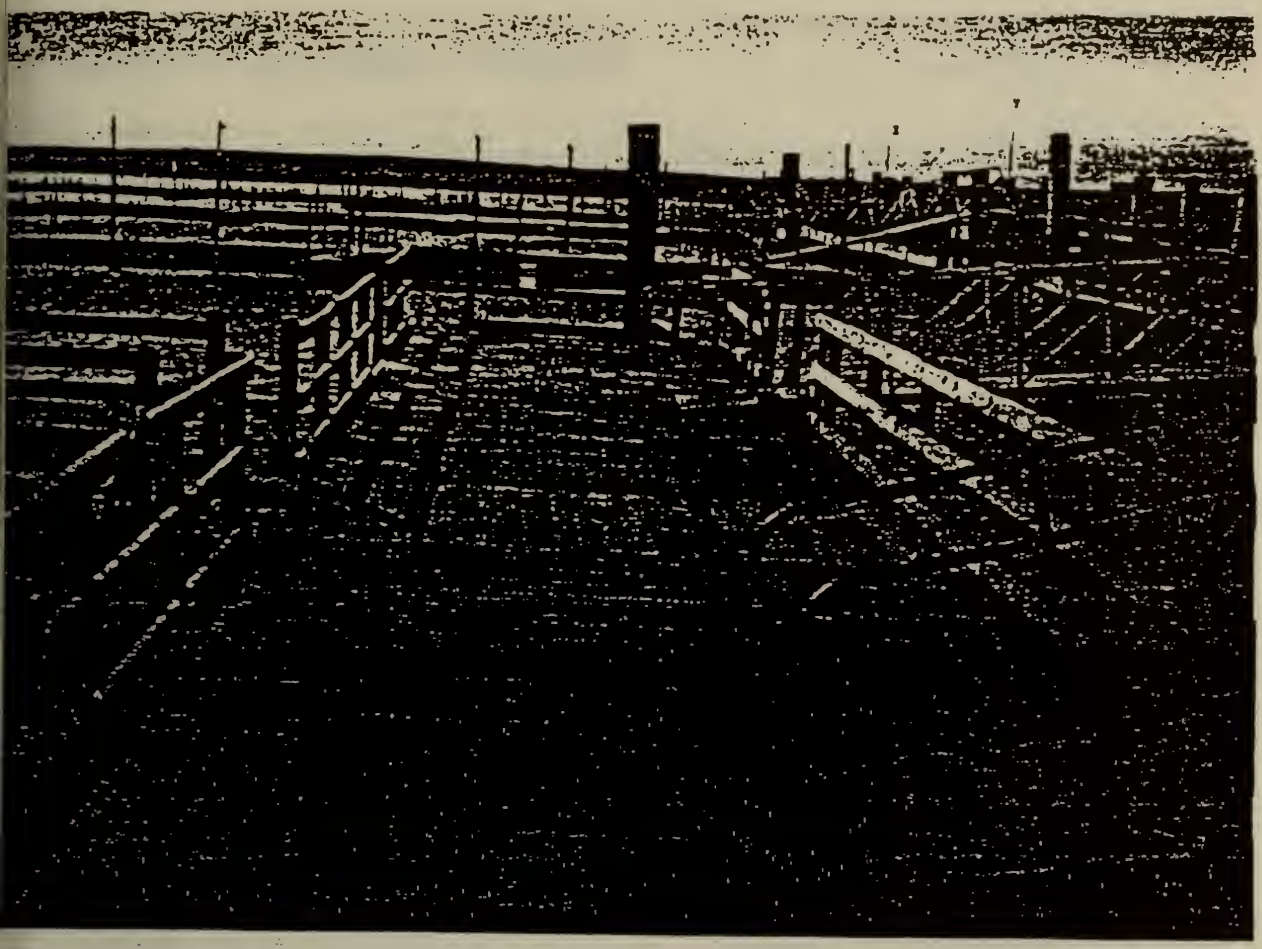


FIGURE 13 - AUTO LOADING FACILITY IN NEW ORLEANS. RAMP ELEVATION IS CONTROLLED BY HOISTS SHOWN ON EITHER SIDE OF RAMP.

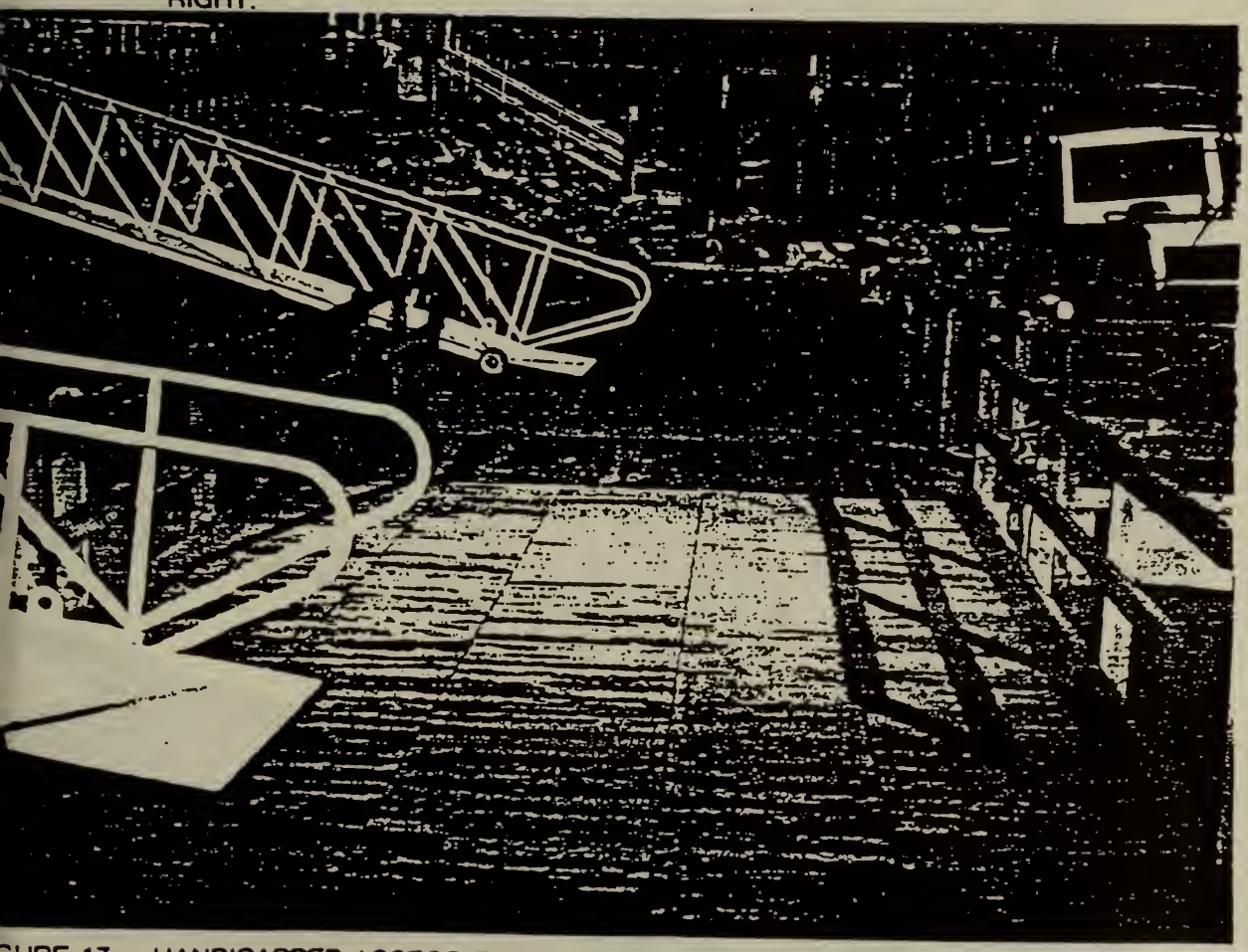


URE 14 - MAIN PIER LEADING TO HANDICAPPED ACCESS FLOAT ON THE LEFT.

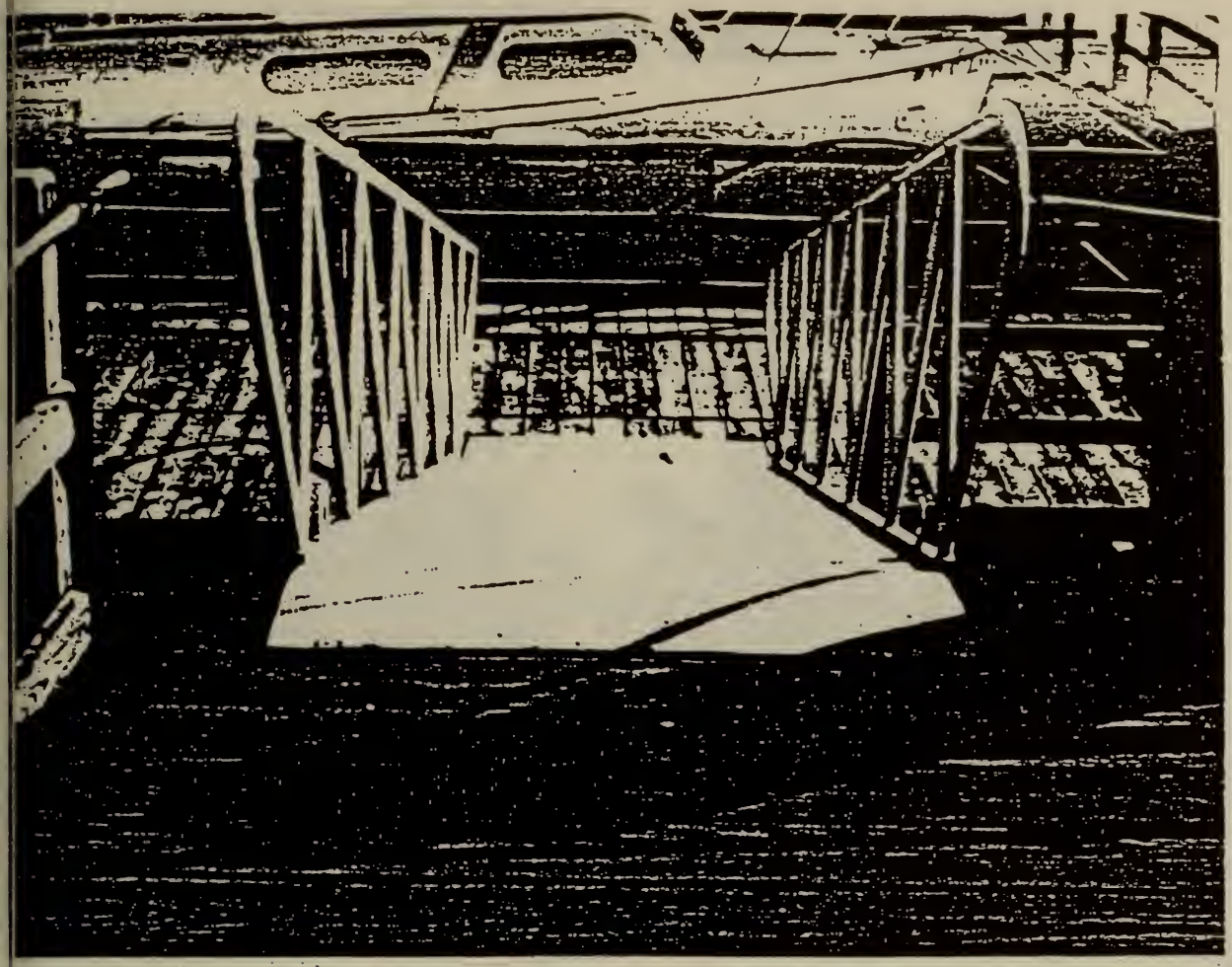
URE 15 - LOOKING UP MAIN PIER. HANDICAPPED ACCESS FLOAT IS TO THE RIGHT.



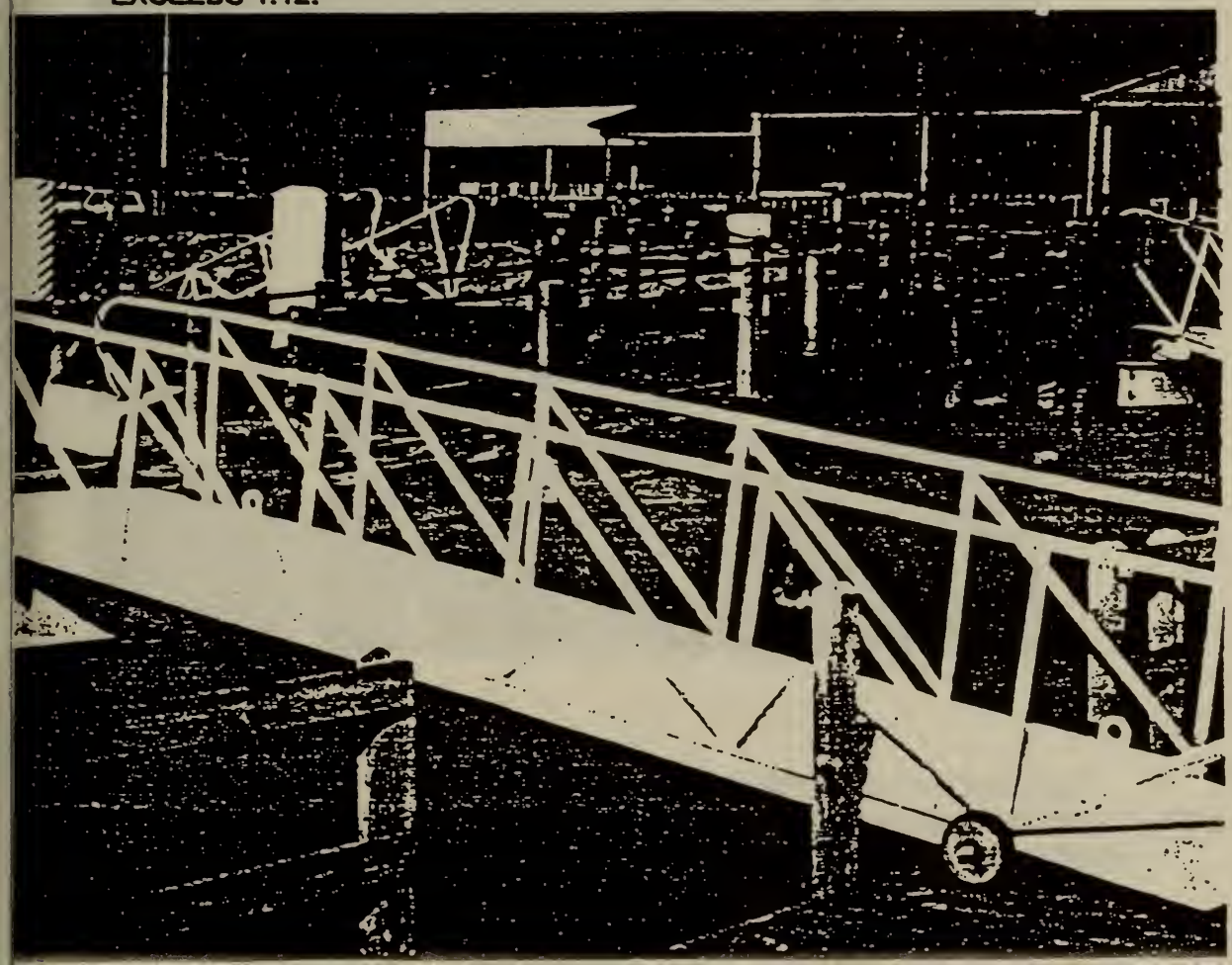
IGURE 16 - HANDICAPPED ACCESS FLOAT. DUAL RAMPS (HIGH AND LOW) ARE ON THE RIGHT.

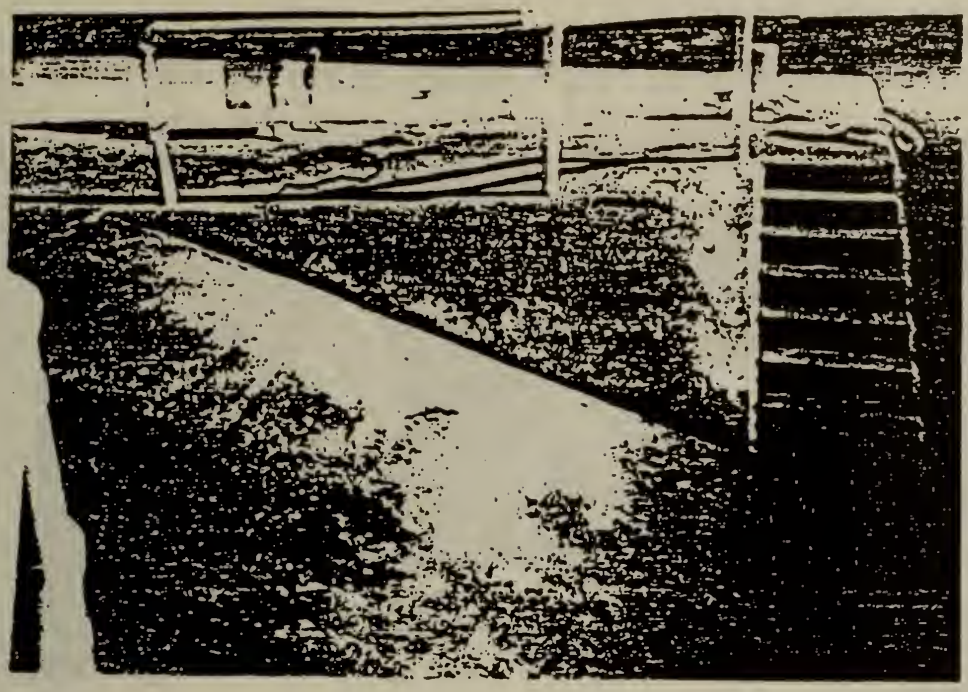


GURE 17 - HANDICAPPED ACCESS FLOAT. LOW WATER RAMP IS IN LEFT FOREGROUND. HIGH WATER RAMP IS BEHIND ON LEFT.

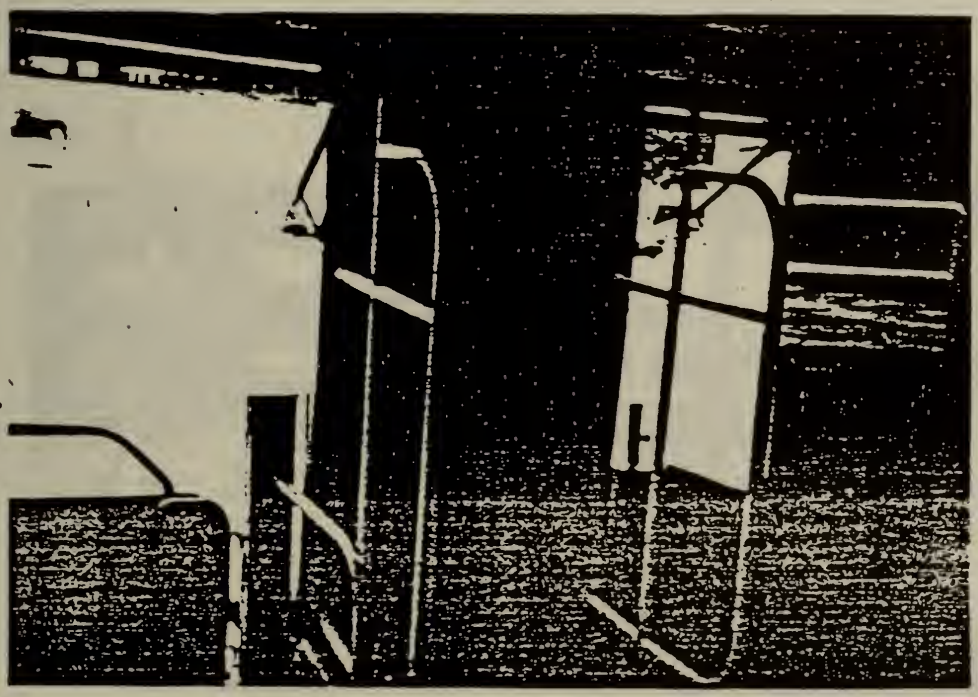


E 18 - LOOKING DOWN HIGH WATER RAMP DURING LOW WATER PERIOD. SLOPE EXCEEDS 1:12.





GURE 20 - CONCRETE RAMP AT ONE END OF THE FERRY TERMINALS IN HAMILTON HARBOR, BERMUDA. NOTE THE STEEP SLOPE OF THE CONCRETE RAMP.



GURE 21 - GANGWAY USED TO GO BETWEEN THE FERRY AND THE RAMP AT THE TERMINALS HAVING RAMPS. THE RAMP IS PULLED INTO THE STORED POSITION BY A HYDRAULICALLY-DRIVEN WINCH MOUNTED BESIDE IT.

IGURE 22 - RAMP SHOWN IN THE DOWN POSITION BEARING ON THE CONCRETE RAMP READY FOR BOARDING AND UNLOADING PASSENGERS.

GURE 23 - NOTICE THE MOPED USING THE RAMP TO BOARD THE VESSEL.

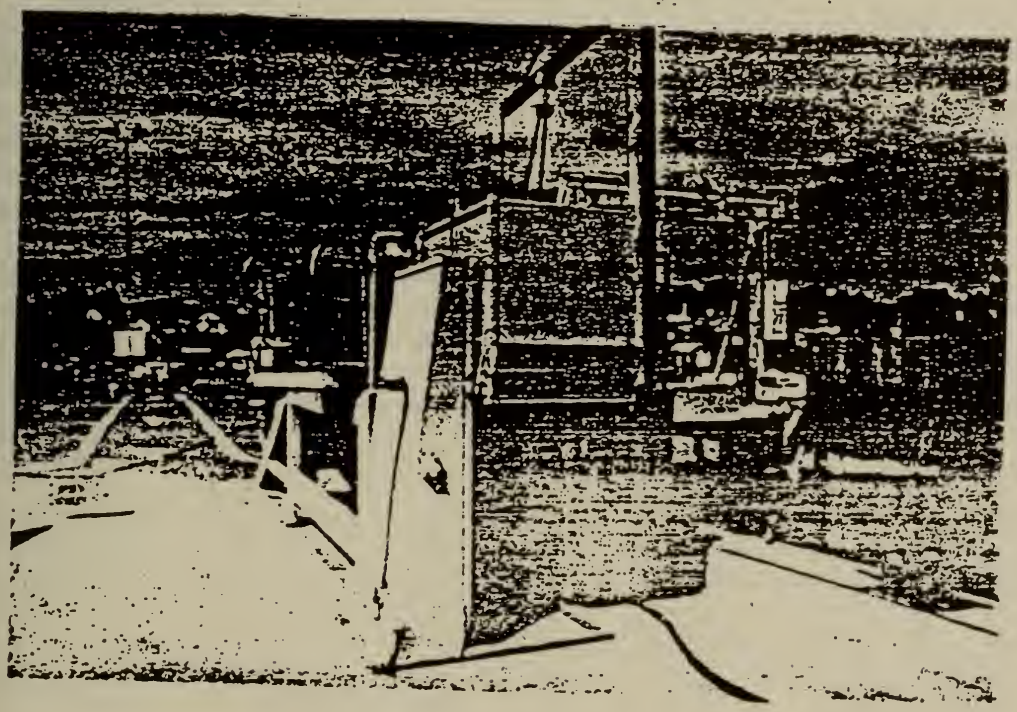
EQUIPMENT OTHER THAN SLOPING RAMPS FOR PROVIDING FULL ACCESS TO VESSELS

ıe Woods Hole, Martha's Vineyard, and Nantucket Steamship Authority have installed "Porch-Lift" wheelchair ıs at their terminals in Woods Hole and Vineyard Haven. The cost is reasonable (under $10,000 each installed in 85). Proper maintenance in the salt air environment is mandatory. (Figure 24 and 25)

"Porch-Lift" is a registered trademark of the American Stair-Glide Corporation.

ıraventa (Canada) of Surrey, B.C. makes two pieces of equipment that could help with handicapped access. The st, their "Stair-Lift" is used for moving people or people in wheelchairs up and down stairs. We looked at this ɔe of equipment in our Rowes Wharf study and concluded that the cost to provide this type of access was prohibi-e. The second, the "Stair-Trac" is a battery-powered crawler mechanism onto which a wheelchair is rolled by the ·son in the chair. The mechanism is used by another person to move the wheelchair and occupant up or down irs. This type of system does not meet the criteria that access be wholly independent of any other person or per-ıs. It does, however, provide access to some of the small boats via their gangway where no fixed lifts or long ıps are available.

URE 24 - "PORCH-LIFT" ELEVATOR FOR WHEELCHAIR ACCESS TO FERRIES AT VINEYARD HAVEN, MA. ELEVATOR DOWN.



RE 25 - SAME FACILITY WITH ELEVATOR UP

CONCEPTS FOR FULL ACCESS FACILITIES

Two types of full access ramp systems were considered initially. Each adjusts the height of the loading float so that it is on the same level as the vessel. In the first system the loading float follows the tide up and down. Floats, which become ramps as the tide falls, each float coming to rest at a maximum slope of 1:12 on a fixed structure, are used to lead from the pier deck to the loading float. The other system uses pumps and flooding systems for adjusting the height of the transition float so that its deck moves from just below the level of the pier deck to just above the level of the loading float.

FULL ACCESS FLOATING RAMP

This system is a modification of the sloping pier system used in Buffalo. It is felt that it is not wise to allow the lower portion of the pier to go below water at every tidal period in salt water where marine growth would make the walking surfaces slick or rough.. In order to allow the ramps to have a maximum slope of 1:12 at low tide and still to be above water at high tide, the sloping piers are actual floats or ramps tied into floats at 32-foot intervals. Each five-foot long horizontal float would be supported on a pile and pile cap system which would limit the minimum elevation of each float. As the tide falls, each float would descend until it came to rest on its support. The difference in elevation between two adjacent floats when they were grounded out would not exceed 2.33 feet which would keep the 32-foot ramp (or float) between them at a maximum slope of 1:12. The ramp system would lead from the pier deck (assumed at elevation of +16 feet above MLW) to a loading float which would be at an elevation of about 3 to 4 feet above the water level. This loading float would also be utilized as a wave breaker to protect the float/ramps behind it. See SK 82287-1.

CONSTRAINTS: This system requires 30 feet of water space offshore from the pier face. This distance could be reduced by making the float/ramps about five feet in width (net four feet between handrails). By reducing these widths the overall distance from the pier would be 24 feet.

FULL ACCESS FLOAT/ELEVATOR

This system utilizes a float with dimensions of about 30-foot width, 40-foot length and 16-foot depth. The float/elevator would be equipped with four pump/flood devices. Access to the float/elevator from the pier deck would be by a ramp having a maximum slope of 1:12 and a length of 32 feet. The float/elevator would be dewatered until its deck was 2.33 feet below the pier deck. Passengers would move to the float/elevator deck and the float/elevator would be flooded down until it was 2.33 feet above the loading float/wave breaker. The passengers would then move down the next ramp to the loading float/wave breaker.

Vertical movement of the float/elevator would be at a rate of two feet per minute. We know that this rate is possible and reasonable from our experience in the design of floating dry docks. Even the largest dry dock moves at a rate of at least one vertical foot per minute. See SK 82287-2.

CONSTRAINTS: This system requires a draft at the pier face of at least 16 feet. It also requires a distance of 42 feet from the pier face.

a result of the studies made concerning the vessels used in Boston Harbor for water taxis, shuttles, commuters harbor cruises and the studies made regarding the environment in Boston Harbor, three sizes of vessel access lities were developed. The first, the smallest would be for small vessels such as day sailers, outboard motor ts and dinghies. These vessels would not exceed 30 feet in length. The second size would be for water taxis, tles, small cruise boats and some commuters. It would be for vessels not exceeding 70 feet in length. The third ld be for all of the vessels in the Boston Harbor "fleet" up to and including the "Naushon" which is 213 feet g.

SMALL BOAT FACILITY

facility would be used by small boats, most of them privately owned/operated. It would be primarily used for ss from a larger boat to land or for transferring passengers to or from sailboats and outboard motor boats. It ld not be intended for mooring boats for long periods of time but rather as a transient dock.

basic parts of the facility would be a float with a method of mooring the float to sustain low energy wave action low energy vessel mooring forces; a ramp which would enable people to transit from land or a fixed pier on and he float; and lighting if the facility were intended for night use. It probably would be removed from the water e winter months and, if left in the water year round, would have to be designed for the heavier harbor waves ice action.

ramp would have to conform to the basic parameters as detailed in this report if the facility were to be intended ull handicapped access. If the facility does not have to meet these standards after review by the appropriate State and Federal agencies, it would be at least have to be able to carry 100 pounds per square foot live load, least forty-four inches wide between railing, have railings conforming to the requirements of the MBC and not ed a slope of 1:8. When steeper than 1:12, the walking surface would have to be coated with an approved slip material (MBC[1] 615.4.1).

float should have a freeboard of between 14 inches and 20 inches with no passenger loading. It should have a num width of eight (8) feet. Vertical live loading should be 20 pounds per square foot over the entire float ce. The float should be able to support a concentrated 500 pound load anywhere without overstressing the structure and without tilting the deck more than 6° from the horizontal.

zontal loading should be as follows: The float should be able to withstand the impact of a vessel up to 30 feet ngth moving toward the float at a minimum speed of two (2) feet per second and it should be able to withstand s of 60 miles per hour and waves of three (3) feet in height with a period of three (3) seconds. It should be lo- in a protected area where wind and wave sizes do not exceed these limits or it must be protected by some type ive barrier. If the float is to be moored against or close to a solid wall, the incoming waves should not exceed 1) foot in height because of the potential of damage from the reflected wave.

mooring system for the float should be either piles or lines (chains) and anchors. Piles must be strong enough ong enough to hold the float under design wind, wave and vessel impact and tidal changes. Anchors must be o withstand these same loads and must be so arranged that the float is kept in place during tidal changes.

ing is to be in accordance with the requirements outlined in these standards.

---

[1] end of description for Code references

Materials for construction are to be as outlined in these standards.

MIDDLE SIZED FACILITIES

The facility for middle sized vessels would consist of a float or floats for mooring the vessels, perhaps overnight; for loading and unloading passengers and perhaps for loading supplies onto the vessel and removing trash at the end of the trip. Storage of consumables would not be done on the float.

The float would be connected to a fixed shore facility (either a pier or land facility) through a ramp system.

The float/floats would be secured by a pile or anchor/line mooring system capable of withstanding the vessel, wave and wind loading and capable of maintaining the float in place during all astronomical and storm tidal cycles. The float and mooring system probably would be expected to remain in the water throughout the year.

If upon approval of cognizant City, State and Federal authorities, this facility does not have to be built for full access by all people, the following details should be used as standards. If it is to be built to allow full access for all people then these standards are to be used except where more stringent requirements are given in the description of the full access facility.

LOADING FLOAT

The loading float will be used for loading and unloading passengers from the boats at the float. Second, it can be used to provide a means for reducing an incoming harbor wave height of three (3) feet with a period of three (3) seconds to one (1) foot or less on the inshore side of the float. If the facility will not have any other floats between the pier and the loading float and if the pier is an open structure as opposed to a solid wall, the wave attenuating feature may be omitted.

Loading on the float is from several different sources. First, the float must be able to support 100 pounds per square foot of live load due to passengers without losing more than one (1) foot of freeboard. Second, it must be able to withstand the impact forces from the incoming design vessel. This impact should be calculated using the displacement of the design vessel and a velocity of 1.5 feet per second normal to the face of the dock due to a vessel approaching at an angle of 15 degrees from a line parallel to the face of the dock. Next, the dock should be able to resist the force imposed by the design vessel moored to the dock and subject to winds of 60 miles per hour and an incoming wave of three (3) feet in height having a period of three (3) seconds. Finally, the dock should be able to withstand a wind of 80 miles per hour and a wave of five (5) feet in height without any vessel moored to it. These dynamic requirements can be modified if computations made/approved by an engineer registered in the Commonwealth of Massachusetts are submitted and accepted by the cognizant authority.

The float must have a freeboard of four (4) feet with no passenger loading. This height will enable the passengers to board most of the vessel at the same height or slightly higher than the vessel deck. Minimum width of the float should be ten (10) feet. The width should be greater than ten (10) feet if required to not allow more than a 6° tilt of the deck from the horizontal when a 500 pound concentrated weight is applied to the deck at any point. The construction materials can be of several kinds:

Steel: Mild steel ASTM-A36 can be used. It must be cleaned to a "near-white surface" and then coated with a corrosion resisting paint such as epoxy.

Aluminum: Type 6061-16T aluminum should be used.

Concrete: Concrete should have a compression strength of at least 4000 psi in 28 days. Type II cement should be used in the concrete.

Timber: Southern Yellow Pine or Douglas Fir should be used. Either material should be protected against marine borer damage by being treated with CCA to a retention of 2.5 pounds per cubic foot or to refusal.

Plastic: Closed cell flotation which will resist flotsam or jetsam damage and which will not be affected by aromatic fuels. The flotation material can be inserted into a container which will resist the aforementioned damage.

Hardware: Fastenings and miscellaneous hardware should be Type 316 stainless steel or hot-dipped galvanized steel.

Sufficient numbers of mooring bitts must be attached to the front edge of the float to enable the vessels loading passengers to approach the float, secure while the loading/unloading process is accomplished and to maneuver away from the float. The bitts must be bolted or welded by all-around welding to develop sufficient strength to hold the cleats in place when loaded to their design loads.

PILES AND SUPPORTING STRUCTURE

Pile used to restrict the movement of the floats and to resist the loads imposed by the wind, waves and vessel floating can be either steel or timber.

Steel piles should be concrete filled pipe piles or H-section piles. Steel should be protected from corrosion by using recommended surface preparation and an epoxy-type coating. Timber piles should be Southern Yellow Pine or Douglas Fir. Treatment of the timber piles should be with CCA to a retention of 2.5 pounds per cubic foot or to refusal.

Float guides shall be of the roller type.

RAMPS

Except where ramps are used in a full access facility (see then the full access description) they should have the following characteristics. The maximum slope should be 1:8. If the ramp ever gets steeper than 1:12 it should be coated with an approved non-skid material (MBC 615.4.1). There should be a clear distance between handrails of at least 48 inches (HAB, NFPA 30-2.3.2 requires only 44 inches). The ramps should be able to carry at least 100 pounds per square foot live load for their full length and clear width (NFPA 5-2.5.4.3). The ramps should have solid floors with no perforations (NFPA 5-2.5.4.2) and should have a non-skid surface (NFPA 5-2.5.4.4). The ramps should have two handrails on each side. The top handrail should be 34 inches above the floor of the ramp (MBC 615.5) and the other 19 inches above the floor of the ramp (HAB). The rails must be able to support horizontal and vertical loads of 50 pounds per linear foot applied separately (NFPA 5-2.5.5.4).

The ramps should be located such that no point on the loading float/wave breaker is more than 120 feet from the entrance to the ramp from the float (NFPA 8-2.6).

It is recommended that the ramps be made of Aluminum Type 6061-T16. This material is strong, light and reasonably resistant to salt spray environment. Any high strength fittings should be of Type 316 stainless steel. Should structural steel be used instead of aluminum, it should be cleaned to a "near-white surface" and coated with a corrosion resistant material such as epoxy. After erection any damage to the coating should be touched up with the same coating used as the primary coating system.

LIGHTING

Where the facilities are to be used after dark, they shall be lighted in accordance with MBC and NFPA requirements. All areas where pedestrians are to walk or stand should be lighted to a level of at least one foot-candle at the walking surface (NFPA 5-8.1.3). Where lighting fixtures transmit light rays beyond the edge of the pier or floats the fixtures should be suitably shaded so that they do not shine over the water (USCG). Primary lighting should not be powered from batteries (NFPA 5-8.2.2). Emergency lighting should be provided wherever primary lighting is required (NFPA 5-9.1.1). Emergency lighting should provide the same level of lighting as the primary source for at least 1-1/2 hours. The lighting level may be diminished to 0.6 foot-candle at the end of this period (NFPA 5-9.2.1, MBC requires only 1 hour).

ELECTRICAL

All electrical wiring, conduit, enclosures and equipment, and the provision of circuit protective devices, shall conform to the applicable requirements of the National Electrical Code and the applicable requirements of the "Fire Protection Standards for Marinas and Boatyards" published by the National Fire Protection Association.

SIGNS

Signs identifying exits must be placed at the point of exit and not more than 100 feet from the exits (NFPA 5-10.1.2) and from each other. If the facility is to be lighted, the exit signs must be lighted to a level of at least five (5) foot-candles (NFPA 5-10.3.2, MBC requires only three (3) foot-candles). Internally lighted signs must have the same visibility as externally lighted signs (NFPA 5-10.3.3). Emergency lighting is required for all lighted exit signs (NFPA 5-10.3.1). It must be at the same level as the normal lighting and must be maintained for the same length of time as the emergency lighting for the rest of the area.

GENERAL

There will be railings at all edges of the pier, ramps and floats except at the loading side of the landing float/wave breaker. The railings will conform to HAB standards, MBC requirements and OSHA standards.

A second means of egress from the loading float must be provided in case of fire (NFPA 30-2.4).

SHORESIDE

Passengers will arrive at the shoreside of the terminal by foot or by motor vehicle. If a covered waiting room is to be provided, it should have seating for 40 people and standing room in excess of 100 people to provide shelter while waiting for the arrival of the shuttle or taxi (see Sketch 822-87-3). A ticket kiosk could be built into the waiting area. Since this type of service is intended for short runs, no sanitary facilities would be provided. It may be possible that a series of water shuttles/ferries or taxis will be developed where one terminal serves boats going to several different places or where vessels leaving one terminal go only to one other location. A color code system matching vessels with terminals or vessels and terminals having several colors to signify common locations should be developed. Waiting areas would be color-coded. Vessel "smoke stacks" would be coded with each terminal color to show where they stopped.

If an access roadway is provided it should be wide enough for passenger vehicles to pass each other (see Sketch SKS22-87-4). A turnaround at the discharge end of the roadway should allow automobiles to change direction and leave. The turnaround should be wide enough to allow vehicles to drop off passengers without stopping the flow of traffic. A curb should be provided along at least the waterside of the roadway to separate the roadway from the "harborwalk" sidewalk which is to be between the road and edge of the pier. An access ramp should be built into the curb in the vicinity of the waiting area.

If parking adjacent to the access facility is to be provided, an entrance to the parking area should be incorporated in the turn- around. Parking should not be placed at the water edge of the pier since it would interfere with the view of the water from the "harborwalk".

FULL SIZED FACILITY

This facility is sized to handle all of the water taxi, shuttles, commuters and cruise boats in Boston Harbor. Our information indicates that the "Naushon" at 213 feet is the longest boat in the present Boston Harbor vessel inventory.

Other, larger vessels may be put into service as the operations in the Harbor increase. Questions of passenger and baggage handling on the shoreside would have to be addressed with ways now used at the "Black Falcon" facility. Since it is not the intent of this study to delve into the details of large vessel operations, these questions will be left for other studies when needed.

If, after review by cognizant City, State and Federal agencies this facility does not have to be a full access facility for all people, the following standards should be met. If full access is required, the additional provisions as outlined under the full access description should be included.

LOADING FLOAT

The same standards as those used for the middle sized facility apply with the following modifications:

The float must have a freeboard of four (4) feet without any passenger loading. Minimum width should be 12 feet.

PILES AND SUPPORTING STRUCTURE

The same standards as those used for the middle sized facility apply.

RAMPS

The same standards as those used for the middle sized facility apply.

LIGHTING

The same standards as those used for the middle sized facility apply.

ELECTRICAL

The same standards as those for the middle sized facility apply.

SIGNS

The same standards as those for the middle sized facility apply.

GENERAL

The same standards as those for the middle sized facility apply.

SHORE SIDE

The same standards as those for the middle sized facility apply.

CODE REFERENCES

NFPA - National Fire Protection Association, Life Safety Code

MBC - Massachusetts Building Code

HAB - Handicapped Access Board

USCG - United States Coast Guard

OSHA - Occupational Safety and Health Act

DESCRIPTION OF A FULL ACCESS SYSTEM

The objective of this full access passenger-handling system is to provide a means for all people to use the present and future water shuttle and taxi service in Boston Harbor from any terminal to any terminal. This system will work through all astronomical tidal elevations. The slope of the ramps will never exceed one (1) foot in twelve (12) feet of length (MBC 615.4). The normal tide range in Boston Harbor is 9.5 feet, the maximum astronomical tidal difference is approximately 14 feet. It is intended that this system be able to operate in a harbor wave climate not exceeding three (3) foot high waves. Inside the loading float/wave barrier the waves must not exceed one (1) foot. The distance between the ends of the ramps where they are attached to platforms or floats must be at least five (5) feet (MBC 615.3).

Pedestrians leaving the main pier structure will exit on a horizontal extension of the pier having a minimum usable width between handrails of five (5) feet. This portion of the fixed pier will be at the same elevation as the main pier. There must be no barriers to the movement from the deck of the main pier to the deck of the projection.

The first ramp will lead on a slope of 1:12 to the first fixed platform. The ramp length will not exceed 32 feet but may be shorter (HAB requirements). The elevation of the fixed platform at the bottom of the ramp must be at least 12 feet 4 inches above mean low water. The next ramp will lead from this fixed platform to the first float. The ramp will be fixed to this float. The pile guides from the float to the piles must allow for a horizontal movement of at least six (6) inches. This space will allow for the foreshortening of the float projection as the floats move up and down between the maximum high tide and the fixed minimum elevation of the float. The floats shall have supports under them such that the maximum difference in elevation between walking surfaces of any adjacent floats shall not exceed 2 feet 8 inches.

SMALL FLOATS USED IN THE FULL ACCESS FACILITY

The floats between the ramps of the system should be able to carry a live load consisting of 100 pounds per square foot on the area where passengers walk between the ramps. They also must be able to carry the weight imposed by the fully loaded ramps. Since these floats will be supported on fixed platforms under the each time the tide falls, they must be able to carry all of their imposed live and dead loads while aground on the float supports. Materials should conform to the same requirements as those described for the loading float.

PILES AND SUPPORTING STRUCTURE

Pile supports for both the vertical live and dead load and horizontal loads imposed by the wind, waves and vessel docking can be either steel or timber. The supporting structure for the ramp/floats should be steel or timber. These supports should have some type of energy absorbing material on their upper surface to cushion any impact which might occur when the float is in a wave climate and the heaving of the float would cause it to pound on the support.

Steel piles should be concrete filled pipe piles or H-section piles. Steel should be protected from corrosion by using recommended surface preparation and an epoxy type coating. Timber piles should be Southern yellow pine or Douglas fir. Treatment of the timber piles should be with CCA to a retention of 2.5 pounds per cubic foot or to refusal.

The piles used to restrict the movement of the floats should be steel or timber. Concrete filled steel pipe piles are recommended. These piles should be protected against corrosion by coating with an epoxy coating after preparing the surface in accordance with methods mentioned above.

Float guides shall be of the roller type. Float guides installed for use in the full access system should be located such that the floats can move horizontally along their long axis six (6) inches to allow for the change in the projection of the ramps as the tide changes.

All descriptions and recommendations for ramps, floats and piles as enumerated in the initial sections of these standards should be applied to the design of the full access facility as well.

APPENDIX 5

NEW YORK CITY'S FERRY PERMIT APPLICATION FORM

NEW YORK CITY
DEPARTMENT OF TRANSPORTATION
BUREAU OF TRANSIT OPERATIONS
Battery Maritime Building New York, N.Y. 10004 212 806-6900

Ross Sandler
Commissioner

Henry F. White, Jr.
Deputy Commissioner

Samuel I. Schwartz, P.E.
First Deputy Commissioner

March, 1987
Doc. #0555B

NEW FERRY SERVICE PERMIT APPLICATION FORM

To promote the growth and development of new ferry services within the New York Metropolitan area, the Department of Transportation has prepared the following New Ferry Services Permit Application Form. It lists the information which must be supplied before the Department can conduct its review of a proposed ferry service.

In general, City policy for new ferry services requires that the service be self-supporting, that it satisfies an active demand for the service and/or relieves the traffic burden on congested highways, that it meets all Coast Guard requirements, and that it does not have any negative traffic or other environmental impacts.

All questions should be fully answered. Where space for answers does not appear on the form or is insufficient, use additional sheets, placing them immediately behind the question sheet involved. If the answer to any question substantially changes prior to the issuance of a permit, the applicant must notify the Department.

Two (2) copies of completed application forms must be submitted. Completed forms or other correspondence should be addressed to:

Walter Thabit, Director of Ferry Planning
NYC Dept of Transportation
Bureau of Transit Planning
51 Chambers Street, Room 1404
New York, N.Y. 10007

It should be noted that additional information, evaluation, and/or approval may be required from NYC DOT or other governmental agencies. Any general questions you have may be directed to Walter Thabit at (212) 566-2980.

A. APPLICANT INFORMATION

1. Applicant Entity

Name _____
Street Address _____

City _____ State _____ Zip Code _____

Telephone(s) _____

2. For Proprietor, Chief Executive Officer (CEO), partners, or joint venturers (with 20 percent or more equity), provide the following information: (Use additional sheets if necessary.)

Name _____
Street Address _____

City _____ State _____ Zip Code _____

Telephone(s) _____

3. Describe character and history of the applicant entity including previous ferry applications, present ferry operations, and/or other ferry operating experience:

_____

_____

_____

B. PROPOSED SERVICE

1. Origin _____

Destination _____

2. Provide on the following page a map, 8 1/2"x 11", showing the route to be followed and all terminals.

C. TYPE OF PERMIT REQUESTED

Special Event (10 days or less) No. of days _____

Temporary, 90 days to 6 months, renewable _____

Permanent (5 year maximum) No. of years _____

D. DEMAND FOR THE SERVICE

On separate sheets of paper following this page, the applicant shall submit a brief market analysis of the potential demand for the proposed route. This analysis shall include at a minimum:

1. Preparation of a map, 8 1/2"x 11" in size, showing the area surrounding the terminal of origin. The map shall indicate the following:

   a. Docking point of the proposed service.

   b. Delineation of the area from which most of the anticipated ridership will be attracted (primary market area).

   c. Sources of ridership originating from outside the primary market area (highway exits, bus lines, rail, etc.)

2. Applicant shall assemble data on the total population in the market area, the number commuting to Manhattan (or other destination), and shall estimate the percentage that will use the proposed ferry based on a comparison with other options, taking into consideration time, convenience and price. Similar estimates should be prepared for out-of-market-area ridership. The basis for the estimates and the data supporting them should be incorporated in a brief market report.

3. Based on the above, ridership on the proposed ferry should be projected for a 3 month, 1 year and 5 year period.

E. SCHEDULING AND RATES

1. Describe in detail the proposed schedule for the new service. If more than one vessel is to be used for the service, the portion of the schedule performed by each vessel must be identified.

2. Indicate procedures for keeping the public informed of operating schedules and changes in operation.

3. Indicate extent to which service will operate in all weather conditons.

4. Submit complete rate schedule.

F. VESSEL INFORMATION

The information requested below should be separately supplied for each vessel to be used in the proposed service - even if two or more vessels are idential except for the name. Note: In addition to the vessels directly responsible for scheduled trips, 1 vessel must be available on 4 hours notice to replace a vessel that has to be taken out of service. Complete information on such a vessel must also be supplied.

1. Vessel Name _____

2. Builder's Name _____

   Address _____

   Date of Construction _____

3. Seating Capcity (not to exceed U.S.C.G. allowance): _____

4. Passenger vessel only? _____

5 Vessel Photo, mounted on 8 1/2"x 11" sheet following.

6. Vessel Plan - top (showing passenger compartments), front and side, shown on 8 1/2"x 11" sheets, following photo.

7. Dimensions

   Length _____

   Width _____ Gross Tonnage _____

   Draft _____ Net Tonnage _____

   Height above water line of passenger loading level: Lower Level _____ Upper Level _____

8. Vessel Loading/Unloading

   Side _____ End _____ Both _____

9. Hull Configuration _____

10. Propulsion System _____

_____

11. Operating Speed _____

12. Noise Levels

Inside Passenger Cabin		Outside Passenger Cabin	
Idle	_____	Idle	_____
Cruising	_____	Cruising	_____

13. Radar _____

_____

14. Other Navigation Equipment _____

_____

15. Crew Size

Required by USCG _____

Proposed _____

G. TERMINAL FACILITIES

For each terminal area, the following information must be supplied.

1. A drawing or map of the docking site 8 1/2"x 11" indicating the following:

   a. Ferry loading/unloading location and arrangement
   b. Terminal facilities including waiting areas, shelter, toilet facilities, signage, etc.
   c. Lighting and security arrangements
   d. Parking area including number of cars

2. The maps should be supplemented by text as appropriate.

3. Indicate ownership of the docking site and its terminal facilities, and any issues surrounding its use as a docking site and terminal.

4. Append copies of leases, commitments to lease, or other site control documents for terminal and/or docking facilities.

H. LOCAL TRANSPORTATION

1. Prepare a map 8 1/2"x 11" showing in detail the location of all local transportation links serving the proposed ferry terminal. This includes bus, subway, automotive and other means of transportation.

2. Describe the land use of the area surrounding the terminal, and any planned development in the vicinity.

3. Indicate present vehicular and pedestrian volumes in the vicinity of the terminal and estimate vehicular and pedestrain volumes once the ferry reaches its projected service level.

4. Indicate any traffic or transportation changes that might be required to serve the new ferry service or that the applicant plans to introduce. This includes traffic lights, signage, new pedestrian walkways, new bus routes, etc.

5. Indicate the impact any proposed changes or new transportation service will have on anticipated vehicular and pedestrian traffic.

I. LOCAL COMMUNITY

The operator shall present the proposed new system to the local Community Board(s) involved and shall include comments from such Board(s) on the proposed service.

J. ENVIRONMENTAL IMPACT

1. Indicate whether dredging, new construction, and/or major repair at either terminal site is required, and detail the work necessary. Enlcose copies of required work or other permits.

2. Indicate any special permits required by Federal, State, or City agencies.

3. Operators applying for a permanent ferry service permit may be required to prepare a Project Data Statement as part of the CEQR (City Environmental Quality Review) process. Such applicants should contact the DOT Office of Ferry Planning for additional information and guidance to complete this part.

K. MAINTENANCE

1. The operator shall describe its maintenance/repair program and schedule designed to insure safe, efficient, and continuous operation. The schedule should include required Coast Guard inspections.

2. Indicate where vessels will be berthed and serviced.

L. PERSONNEL

1. Describe the qualifications of key personnel such as general manager, terminal personnel and administrative personnel as appropriate.

2. Describe qualifications of vessel captains; enclose certification documents.

M. INSURANCE

The operator shall describe the insurance program that will be in force including at a minimum:

1. Protection and Indemnity Insurance with combined single limit for bodily injury, personal injury and property damage in an amount of not less than $15 million.

Note: Such insurance shall name the City of New York and the New York City Department of Transportation as additional insureds.

2. Workmens Compensation Insurance, subject to the approval of the Deputy Commissioner of Transit Operations.

Note: A confirmation of the issuance of the required insurance must be submitted prior to issuance of the permit. Two(2) copies of the actual policy are to be submitted to the Director of Ferry Planning within 30 days of the issuance of the permit.

N. PROFIT AND LOSS

Compare total projected operating costs with anticipated revenue, at a minimum as described below. Estimate profit or loss, first year of operation.

COST

Capital Costs

Vessels _____
Terminal Improvements _____
Other _____

Total Capital Costs _____

Annualized cost _____

Operating Costs

Crew _____
Fuel _____
Oil _____
Maintenance/Repair _____
Terminal/Docking _____

Total Operating Costs _____ _____

General/Administrative Costs _____

Total Yearly Costs _____

PROJECTED REVENUE

Fares _____

Other _____

Total Revenue _____ _____

PRO FORMA PROFIT OR (LOSS) _____

O. BACKGROUND CHECK

In addition to these requirements, a personal and business questionnaire must be filled out for the principals and the applicant entity. Business references must also be supplied. Forms are available from the Director of Ferry Planning.

APPENDIX 6

RESOURCE DIRECTORY

Local Government

Agency

Boston Redevelopment Authority

Address

Boston Redevelopment Authority
One City Hall Square/9th Floor
Boston, MA 02201

Harborpark Offices
Building 34, One First Avenue
Charlestown, MA 02129

Contact Person(s)/Phone No.

Stephen Coyle, Director

Harborpark Staff:

John R. Leigh, Assistant Director
J. Edward Roche, Director of Harborpark
(617) 242-2282

Agency

Economic Development and Industrial Corporation of Boston

Address

Economic Development and Industrial
Corporation of Boston
38 Chauncy Street
Boston, MA 02111

Contact Person(s)/Phone No.

Marilyn Swartz Lloyd, Director
Douglas R. Herbrerich, Deputy Director
for Policy, Planning and Development
(617) 725-3342

Agency

Environment Department

Address

Environment Department
City of Boston
One City Hall Square
Boston, MA 02201

Contact Person(s)/Phone No.

Lorraine Downey, Director of Environment Department and Chairperson of Harborpark Advisory Committee
(617) 725-3850

Agency

Transportation Department

Address

Transportation Department
City of Boston
One City Hall Square
Boston, MA 02201

Contact Person(s)/Phone No.

Richard Dimmo, Commissioner of Transportation Department and Member of the Harborpark Advisory Committee
(617) 725-3076

State/Metropolitan Government

Agency

Coastal Zone Management

Address

Coastal Zone Management
Executive Office of Environment Affairs
Commonwealth of Massachusetts
100 Cambridge Street
Boston, MA 02202

Contact Person(s)/Phone No.

Richard Delaney, Director
(617) 717-9350

Agency

Executive Office of Transportation and Construction

Address

Executive Office of Transportation
and Construction
Commonwealth of Massachusetts
10 Park Plaza / Room 3510
Boston, MA 02116

Contact Person(s)/Phone No.

Frederick P. Salvucci, Secretary
Larry Harman, Assistant Secretary
Joy Hearn, Water Transportation Program Director
(617) 973-7020

Agency

Department of Environmental Management

Address

Department of Environmental Management
Commonwealth of Massachusetts
100 Cambridge Street / 19th Floor
Boston, MA 02202

Contact Person(s)/Phone No.

James Gutensohn, Commissioner
(617) 727-3163

Bob Kumor, Deputy Commissioner
(617) 727-3160

Agency

Department of Environmental Quality Engineering (DEQE)

Address

Division of Wetlands and Waterways Regulations (DWWR)
Department of Environmental Quality Engineering
Executive Office of Environmental Affairs
Commonwealth of Massachusetts
One Winter Street / 7th Floor
Boston, MA 02109

Contact Person(s)/Phone No.

Dan Greenbaum, Commissioner DEQE
(617) 292-5500

Gary Clayton - DWWR
(617) 292-5695

Agency

Massachusetts Bay Transportation Authority

Address

Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, MA

Contact Person(s)/Phone No.

James F. O'Leary, General Manager
Sophie Yeragotelis, Project Coordinator, Construction Development

(617) 722-4478

Agency

Massachusetts Department of Public Works

Address

Massachusetts Department
of Public Works
Executive Office of Transportation
and Construction
Commonwealth of Massachusetts
10 Park Plaza/ Room 6610
Boston, MA 02221 - 3973

Contact Person(s)/Phone No.

Terry Murray - Project Manager
(617) 973-7322

Agency

Massachusetts Port Authority

Address

Massachusetts Port Authority
10 Park Plaza
Boston, MA 02116

Contact Person(s)/Phone No.

David Davis, Executive Director
(617) 973-5500

Robert M. Reyes, Senior Land Use Planner
(617) 973-5390

Agency

Massachusetts Water Resources Authority

Address

Massachusetts Water Resources Authority
100 First Avenue
Charlestown, MA 02129

Contact Person(s)/Phone No.

Paul Levy, Executive Director
Michael Ralph, Public Affairs Director
(617) 242-6000

WTR1/07.RPT
021389/6

Agency

Metropolitan District Commission

Address

Metropolitan District Commission
Commonwealth of Massachusetts
20 Somerset Street
Boston, MA 02108

Contact Person(s)/Phone No.

William J. Geary, Commissioner
Julia B. O'Brien, Planning Officer
(617) 727-9693

WTR1/07.RPT
021389/7

Legislative Commissions

Agency

Special Legislative Commission on the Development of Boston Harbor

Address

Special Legislative Commission on
the Development of Boston Harbor
State House / Room 15
Boston, Ma 02133

Contact Person(s)/Phone No.

Senator Michael Flaherty, Acting Chairman
Mary Ellen Hall
(617) 722-1677

Agency

Legislative Special Committee on Marine Transit

Address

Legislative Special Committee on
Marine Transit
State House
Boston, MA 02133

Contact Person(s)/Phone No.

Representative Stephen J. Karol, Chairman
Patricia Worth, Research Director
(617) 722-2960

Federal Government

Agency

Boston National Historical Park (U.S. Department of the Interior, National Park Service

Address

Boston National Historical Park
Charlestown Navy Yard
Charlestown, MA 02129

Contact Person(s)/Phone No.

John J. Burchill, Superintendent
(617) 242-5644

Massachusetts Association of Passenger Vessel Owners

Members

A.C. CRUISE LINE
Al Circeo
28 Northern Avenue
Boston, MA 02110
426-8419

BASS POINT CRUISE LINE
Richard Tgettis
P.O. Box 80
Nahant, MA 01908

BASS RIVER CHARTERS
Paul R. Collins
P.O. Box 672
Beverly, MA

BAY STATE PROVINCETOWN CRUISES
Carolyn Kiley
20 Long Wharf
Boston, MA 02110

BOSTON HARBOR CRUISES
Rick Nolan
One Long Wharf
Boston, MA 02110
227-4320

BOSTON PARTY BOATS
Richard Dickey
Seven Elwood Street
Charlestown, MA 02129

CAPTAIN LOU, INC.
Louise Twitchell
68 Edward Street
Medford, MA 02155
396-4096

CAREFREE CRUISES
Jerry Van Dalinda
433 Hanover Street
Boston, MA 02113
723-6446

HYANNIS HARBOR TOURS
R. Murray Scudder
22 Channel Point Road
Hyannis, MA 02106

WTR1/07.RPT
021389/10

ISLAND COMMUTER CORP.
Herbert Weeks, Jr.
303 Dilingham Avenue
Falmouth, MA 02540

M AND M MARINE SERVICES
Phillip McMann
619 East Broadway
South Boston, MA 02127
268-2244

MASS BAY LINES
Jay Spence
183 Whiting Street
Hingham, MA 02143
749-4500, 241-9006

SEA EXPLORER CRUISES
Peter Tropeano
19 Revere Street
Lexington, MA 02173

SKYLINE CRUISES
Ed Burns
239 Shore Drive
Winthrop, MA 02152

SPIRIT OF BOSTON
Frank Grealish
290 Northern Avenue
Boston, MA 02210
542-2974

YANKEE FLEET
Tom Hill
75 Essex Avenue
Gloucester, MA
281-1573

Massachusetts Association of Passenger Vessel Owners

Associates

Alvin Edwards
C.G. Edward, Inc.
272 Dorchester Avenue
Boston, MA 02127

Donald Phipps
Ocean Maring Services
C-1 Shipyard Place
13th Street
Charlestown, MA 02129

Franco Di Benedetto
Carefree Cruises
433 Hanover Street
Boston, MA 02113

George Reitano
Captain Lou, Inc.
68 Edward Street
Medford, MA 02155

William Spence
Mass Bay Lines
183 Whiting Street
Hingham, mA 02143

Viking Gustafson
55 Highland Avenue
Winthrop, MA 02152
241-9006, 846-8583

Thomas Murphy, Jr.
280 Beacon Street
Boston, MA 02116
267-2180

Jamie Fay
Fort Point Associates
300 Congress Street
Boston, MA 02210

George Duclos
Gladding Hearn Shipbuilding
One Riverside Avenue
Box 300
Somerset, MA 02726

WTR1/07.RPT
021389/12

APPENDIX 7

BIBLIOGRAPHY OF WATER TRANSPORTATION STUDIES

BIBLIOGRAPHY

Boston Harbor Waterborne Transportation. Cambridge Systematics. October 1984.

Boston Inner Harbor Water Dependent Use Report. The Boston Harbor Associates. October 1986.

City of Boston Water Transportation Policy. City of Boston Transportation Department. September 1985.

Habib, P.; Block, A.; Ruess, R. Functional Design of Ferry Systems. July 1980 Maritime Administration, U.S. Department of Commerce. Marad Report No. MA-RD-9700-80085.

The Harbor Islands State Park Master Plan. Wallace, Floyd Associates. July 1986.

High Spped Waterborne (HSW) Transportation Study. UMPTA U.S. DOT, Office of Technical Assistance. Washington, D.C. 20590. Contract No. DTUM-60-82-C-7150. September 1984.

Inventory of Harbor Water Transportation. Cambridge Systematics. August 1984.

Logan Airport/Boston Harbor Water Transportation Study. Tams Consultants, Inc.; C. Raymond Hunt Associates, Inc.; Charles Norris. June 1988.

Management of Downtown Wharf Space. Cambridge Systematics. December 1984.

Case, John. "The SEA-BUS Story." Marine Technology Vol. 18, The Society of Naval Architecute and Marine Engineers. October 1981. pp. 350-364.

Prototype Docking Standards for Boston Harbor. Childs Engineering Corporation. November 1988.

Case, John. The SEA-BUS Manned Simulator. Maritime Research Center, Kings Point, N.Y. June 14, 1981. "MARSIM 81."

Special Problems of Waterfront Development. Sasaki Associates, Inc. Spring 1985.

Water Use Planning - Boston Harbor. Sasaki Associates. December 1986.

The Wave of the Future. Boston Redevelopment Authority, Office of Harbor Planning and Development. October 1986.